IBM 4341 and 4381 Processors

Installation Manual– Physical Planning

4341 and 4381 Processors

IBM

IBM 4341 and 4381 Processors Installation Manual – Physical Planning

GA24-4017-2

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Warning: This equipment generates, uses, and can radiate radio frequency energy and if not installed and used in accordance with the instructions manual, may cause interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment. Operation of this equipment in a residential area is likely to cause interference in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

Instructions to User: Properly shielded and grounded cables and connectors must be used for connection to peripherals in order to meet FCC emission limits. Proper cables are available from IBM authorized dealers. IBM is not responsible for any radio or television interference caused by using other than recommended cables or by unauthorized modifications to this equipment. It is the responsibility of the user to correct such interference.

Third Edition (June 1988)

This is a major revision of, and obsoletes GA24-4017-1 and Technical Newsletters GN24-1024 (19 May 1987) and GN24-1036 (23 Oct 1987). New information on the IBM 4381 Processor Model Groups 91E and 92E has been added where applicable.

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Preface

This manual contains information necessary for you to plan and prepare the physical site for the installation of the IBM 4341 and 4381 Processors. You should become familiar with the contents of this manual before beginning any installation planning.

Before using this publication in connection with the operation of IBM systems, consult the latest *IBM System/370 and 4300 Processors Bibliography,* GC20-0001, for the editions that are applicable and current.

This manual is divided into the following sections:

Chapter 1 contains information on floor planning, electrical, environmental, and structural requirements.

Chapter 2 gives detailed specifications and cabling information for the 4341 and 4381 Processors.

Appendix A contains general cabling information.

Appendix B contains power cord specifications and plug installation for World Trade countries.

Appendix C is a list of physical planning templates.

Appendix D contains information about communication lines.

Appendix E contains FCC regulations governing integrated protective circuitry.

Appendix F contains plugs and receptacles for 60-Hz power cords.

Appendix G is a checklist to be used as an aid in installation planning and scheduling.

Appendix H contains translations of safety-related information.

Note: This manual is intended for use with the companion manuals *IBM Input/Output Equipment Installation Manual – Physical Planning,* Order No. GC22-7064, and *IBM Input/Output Equipment Reference Installation Manual – Physical Planning: System/360, System/370, and 4300 Processors,* GC22-7069. The chapters and appendixes that apply to your data processing installation may be combined in a single binder.

Installation information for the 4321, 4331, and 4361 can be found in a new publication *IBM 4321/4331/4361 Installation Manual – Physical Planning,* GA33-1577.

Associated Publications

- *IBM 4300 Processors Principles of Operation for ECPS:VSE Mode,* GA22-7070
- *IBM 4300 Processor Summary and Input/Output & Data Communications Equipment Configurator,* GA33-1523
- *IBM 4381 Processor Summary and Input/Output & Data Communications Equipment Configurator,* GA24-3950

- *IBM 4341 Processor Physical Planning Template (Metric Units)*, GX24-3729
- *IBM 4341 Processor Physical Planning Template (English Units)*, GX24-3666
- *IBM 4381 Processor Physical Planning Template (Metric Units)*, GX24-3951
- *IBM 4381 Processor Physical Planning Template (English Units)*, GX24-3952
- *Installation and Assembly of Coaxial Cable and Accessories for Attachment to IBM Products*, GA27-2805
- *IBM 3270 Information Display Station Installation Manual – Physical Planning*, GA27-2787
- *IBM 3790 Communications Terminals Installation Manual – Physical Planning*, GA27-2769
- *IBM Remote Multiplexers and Communications Terminals Installation Manual – Physical Planning*, GA27-3006
- *IBM Multiuse Communications Loop Planning and Installation Guide*, GA27-3341.

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Chapter 1. Preinstallation Planning

You (the customer) are responsible for all site preparation, including suitable space, floor layout design, and facilities for the equipment. The successful installation of a data processing equipment configuration requires long-range planning and continuous supervision to ensure that the plans are accomplished. Schedule preinstallation activity so that the data processing area and supporting facilities are ready when the equipment is delivered.

Prepare a list of the equipment components, storage cabinets, work tables, and other furnishings needed for the installation. For large or complex installations, consider forming a preinstallation consulting and service group familiar with the subjects covered in this manual.

Scheduling the Installation

IBM will provide a customized information package containing product specification sheets, templates, and installation planning manuals for the equipment you have ordered. Refer any problems or questions you may have about your site preparation responsibilities to your IBM representative.

Data processing installations differ. However, you can use the following schedule as a guide (also see Appendix G, "Installation Planning Schedule and Checklist" on page G-1).

Eight Months before equipment delivery (ten to twelve months if structural alterations are required):

1. Verify the IBM equipment to be installed.
2. Determine the location for the equipment. Make a preliminary layout of the proposed installation. Consider:
   - Room size
   - Physical layout of the equipment
   - Floor loading
   - Use of raised floor
   - Electrical power requirements
   - Air conditioning requirements
   - Data communications facilities
   - Channel priorities and optimization (sequence of attached devices)
   - Atmospheric contamination.
3. Survey specific requirements for moving IBM equipment from the delivery area to the data processing area. For details, see "Space and Layout Requirements" on page 1-3.
4. Advise IBM of any special security procedures, physical access restrictions, or other requirements.
5. Study availability and delivery quotations for power, air conditioning, cables not supplied by IBM, and other equipment to determine when each item must be ordered and delivered.

Six Months before equipment delivery:

1. Verify the air conditioning and power requirements and schedules.
2. Verify the delivery and installation schedule.

Four Months before equipment delivery:

1. *This is a critical point in the schedule.* Prepare the final layout of the installation and submit it to IBM for review. The cable order (prepared by IBM) is based on the final layout. After the cables are ordered, no layout changes that affect cable lengths should be made.
2. A separate cable order must be submitted for all equipment that is shipped three months after the original shipment of equipment. The ordered cables arrive with the individual units.
3. When a unit requires external cables that must be installed through walls and/or floors, arrange for ordering, delivery, and installation with sufficient lead time to ensure availability for system installation.
4. To ensure availability of equipment for system installation, arrange for common-carrier facilities to be installed for connection to the optional remote support facility (RSF) and for any planned telecommunication equipment.

Two Weeks before equipment delivery:

1. Cables are delivered. It is your responsibility to have the cables set in place. Under normal circumstances, IBM will set cables for IBM equipment in place at your request. However, if non-IBM personnel are selected, IBM will furnish, upon your request, a representative to designate which cable applies to each unit and, if applicable, a cable layout diagram. IBM has the responsibility to connect cables between IBM units.

   Cables are shipped with machines for some countries.
2. Place IBM customer engineering equipment, when delivered, in the CE service area according to the final layout.

One Week before equipment delivery:

1. If a raised floor is used, cut the cable holes in the raised floor panels (see specification pages). Before installing the equipment, take necessary safety precautions to prevent injury to personnel because of exposed holes.
2. Have all air conditioning equipment installed, tested, and ready for operation. (Balance the air conditioning system as soon as possible after the IBM equipment has been installed.)
3. Complete painting, plastering, decorating, and installing floor ramps, lighting, and electrical and communication facilities (including any necessary communications lines, modems, etc.).

Building Requirements

When selecting a location for the computer installation, consider :

1. Availability and location of proper and adequate power (including standby power where required).
2. Space for, and location of, air conditioning equipment (compressor, air handling equipment, and cooling tower or condenser).

3. Finished minimum floor-to-ceiling height of 2.44 meters (8 feet—for environmental considerations).
4. Work flow to other areas.
5. Space for storage cabinets, card files, desks, communication facilities, etc., as well as for the daily storage of tapes, cards, and other supplies.
6. Floor loading capacity.
7. Proper safety and fire precautions.
8. Electromagnetic interference.
9. Excessive atmospheric contamination in the operating environment, such as corrosive gases, dust, and radio-frequency interference. If the computer room is adjacent to a manufacturing area, ensure that holes (such as around pipes and telephone lines) in the floor, ceiling, and walls are sealed to prevent flammable, toxic, or corrosive gases from entering the computer room. The presence of odors from corrosive gases generally indicates an environment that may harm electronic equipment.
10. Access between the receiving dock and the data processing area for movement of the equipment.

Space and Layout Requirements

Space and layout requirements differ for each equipment configuration, and depend on the intended applications, as well as the physical area available. A few general rules are:

1. The floor area required for the equipment is determined by the specific components to be installed, the location of columns, floor loading capacity, provision for future expansion, etc.
2. As a preliminary check for clearance problems, paper templates of the units (made to the scale of your building plans) can be used on the building plan itself. It may be convenient to make a rigid, full-scale template of the largest unit. Carry this template along the access route to check for potential clearance problems at doorways, around passageway corners, and in elevators.

   Discuss access-route clearance problems with your IBM representative. IBM 4300 Processors are shipped with the covers in place. If necessary, covers may be removed. Unless otherwise noted on individual specification pages, units can be reduced to at least 750 x 1 525 millimeters (29.5 x 60 inches).
3. Provide space for storage cabinets, card files, desks, communications facilities, etc., as well as for the daily storage of tapes, cards, and other supplies.
4. Store all combustible materials in properly designed and protected storage areas. See "Safety and Fire Precautions" on page 1-21 and "Storage of Data Recording Media" on page 1-23.
5. At the option of IBM, test equipment may be assigned to the installation to maintain the equipment. The test area should be located on the same floor level as the computing equipment. For detailed information, see "Customer Engineering Support Facilities" on page 1-27.

Equipment Layout

Before designing a layout, assign priorities to the input/output channels and to the control units to be attached to the channels. See "Channel Priority" on page 1-25.

Operational requirements determine the specific location of the various components in the computer room. Because the separate components are connected by cables of specified length, and because of space limitations, priority, and the necessity for maintaining clearances between units for servicing, work space, and aisles, you may need to prepare and analyze several tentative layouts before deciding on the final plan.

If you plan to install the equipment in two or more stages, a separate layout should be prepared for each stage. Consider channel priority assignments and cable lengths for each stage.

To make a layout, an accurate drawing of the proposed area is necessary. For a precise layout, transparent plastic templates are available from IBM (see Appendix C, "Template List" on page C-1). The templates show the required space for the weight distribution and the required clearances to allow working room for operator and service personnel and test equipment. Templates also show the radius of swinging gates and covers, and the location of casters and cable holes. Clearances shown on the templates may be overlapped as long as the larger clearance is maintained, except that the gate swing of an auxiliary unit must not interfere with the gate swing of its corresponding control unit.

Equipment must be located so that the length of connecting cables does not exceed the maximum limits. These limits may vary. Refer to the specification pages and cable schematics for the appropriate limits.

The prepared layout must be accurate and to scale. IBM uses the layout to determine the appropriate cable lengths. Be sure to include the following items, as well as any other unique considerations, on the layout:

1. Service clearances required for each unit.
2. If the equipment is to be installed on a raised floor:
   a. Indicate the location of any obstruction or constriction that may affect cable routing.
   b. Indicate the height of the raised floor above the base floor.
3. If the equipment is *not* to be installed on a raised floor:
   a. Indicate the planned placement of cables for minimum obstruction.
   b. If cables are to be routed indirectly between units (such as along walls or suspended), indicate the amount of additional cable required.
4. Location of power receptacles.
5. The number of control units to be assigned to each channel.
6. The number of input/output units to be attached to each control unit.
7. Location of air conditioning equipment and controls.
8. Location of file cabinets, desks, and other office equipment.
9. Location of room emergency power-off controls.
10. Location of all entrances, exits, windows, and columns or pillars.

Also consider the following when planning the layout:

1. Flow of work and personnel within the area.
2. Operator access to units, as required.
3. If the equipment is *not* to be installed on a raised floor, consider:
   a. The maximum cable lengths.
   b. The need for mechanical protection, such as cable guards or ramps, for the safety of personnel and equipment.
4. The effect of channel sequence or priority on the physical layout of the units.
5. The visual access required between a control unit and at least one of its associated input/output devices.
6. Avoiding direct sunlight where display units are to be located. The recommended lighting level is 800 lux (75 foot-candles).
7. Location of any planned safety equipment.
8. Future expansion.

Review the final layout to ensure that cable limitations have not been exceeded and that proper clearances have been maintained.

Note: Cables are ordered four months before equipment installation.

Notify IBM immediately of any layout changes that affect cable lengths.

Changes in the requested cable specifications within three months of the scheduled shipment date may subject you to an additional charge.

Floor Construction

The floor must be capable of supporting the equipment. The weight of each unit is listed on its specification page.

IBM considers the following factors in determining floor loading:

1. If three or more units are placed side by side (abutted), no allowance can be taken for side clearance at the ends of the units.
2. Regardless of the actual service clearances required, the total area used in floor loading computations cannot extend more than 760 millimeters (30 inches) in any direction from the unit.
3. 98 kg/m^2 (20 pounds/foot^2) of service clearance area used in the calculation must be applied as *live load* in floor loading computations.
4. If a raised floor is used, 50 kg/m^2 (10 pounds/foot^2) of total area must be used as the raised floor load in the floor loading calculations.
5. The weight of cables has been considered as part of the unit weight.
6. Most office building floors rated at 250 kg/m^2 (50 pounds/foot^2) have an additional allowance of 125 kg/m^2 (25 pounds/foot^2) for partitions. The local building code authority should be contacted about using this partition allowance in determining the floor loading capacity.

Use of Raised Floors

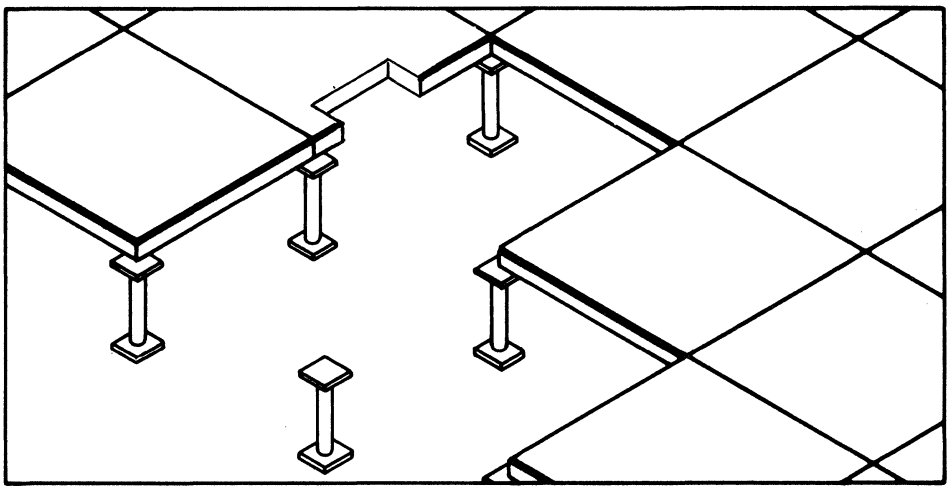
A raised floor accomplishes the following major objectives:

1. Allows for future layout flexibility with minimum reconstruction cost
2. Protects the interconnecting cables and power receptacles
3. Provides safety for personnel
4. Permits the space between the original floor and the raised floor to be used to supply air to the equipment and/or area.

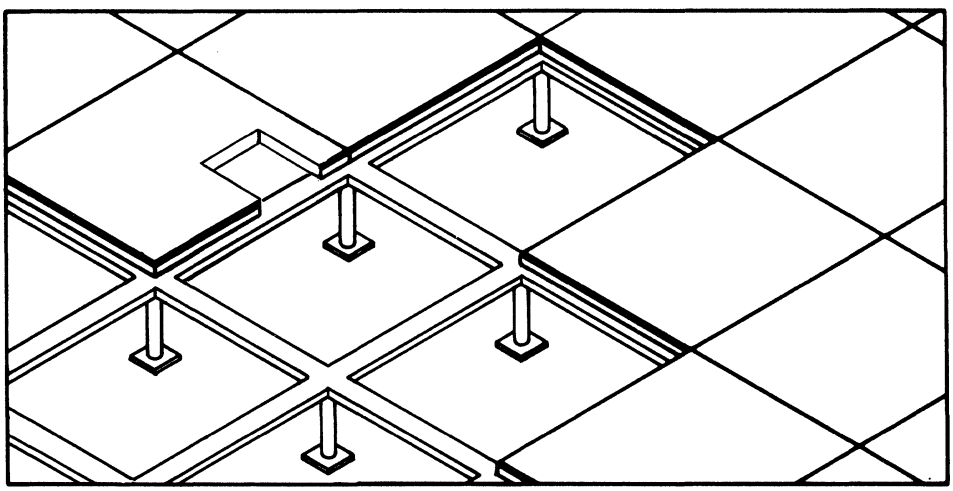
A raised floor can be constructed of steel, aluminum, or fire-resistant wood. The two common floor types are shown in Figure 1-1.

If a raised floor is not used, cable guards or ramps should be provided for the safety of personnel.

Free-Access Floor:
Pedestal Supported Panels
Panels Removable
Cutouts in Panels



Free-Access Floor:
Subframing Supported Panels
Panels Removable
Cutouts in Panels



Note: A raised-floor panel lifter should be made readily available in the computer room at a convenient location.

Figure 1-1. Types of Raised Floors

Raised Floor Recommendations

In the construction of raised floors, the following recommendations should be followed:

1. Where a metallic raised floor is used, ensure that no metal is exposed to the walking surface; such exposure may constitute an electrical safety hazard. Providing a conductive path from a metallic raised floor structure to ground is necessary to minimize static buildup.
2. The raised floor height should be 300 millimeters (12 inches).

   The raised floor clearance should be adequate to accommodate piping, power distribution, etc., with an additional minimum of 115 millimeters (4.5 inches) allowed for passage of cables and connectors over or under these or other obstacles.
3. When a raised floor panel is cut for cable entry, air register, etc., additional panel support may be required to restore structural integrity.
4. Protective covering should be used to prevent damage to floor tiles, carpeting, and panels while equipment is being installed or relocated.
5. Sharp edges must be removed from all floor cutouts through which cables pass.
6. Concrete subfloors may require treatment to prevent the release of dust.

Floor Covering Recommendations

For floor covering recommendations, refer to *IBM General Information Manual, IM-PP, GC22-7082.*

Furniture

Furniture can provide a source of high static charge. Ensure that seat covers, etc. are made of materials that resist static buildup. Many plastics permit the buildup of high static charges. Cloth-covered chairs are normally less susceptible to generating static charges. Casters, mats, pads, etc. made of rubber or other insulating materials should be avoided, unless they contain conductive material. If metal casters, ball bearings, etc. are used, a graphite or other conductive lubricant should be used.

The resistance of furniture parts that touch the floor (such as casters and feet) should be less than 10^9 ohms measured from the metal in the furniture frame to a metal test surface upon which the furniture sample is placed.

Acoustic Treatment of Area

Acoustic treatment of the computer room is recommended to provide for more efficient and comfortable operation. Proper acoustic design of a computer room may require the services of an acoustic specialist.

The total environmental noise level of a computer room is affected by all noise sources in the room, the physical arrangement of the noise sources, and the sound reflective (or absorptive) characteristics of the room surfaces.

The noise level in an installation can be reduced by proper spacing and orientation of mechanical equipment. Sufficient space should be provided around such units. The farther apart they can be placed, the lower the overall room noise will be. When possible, place the noisier units so that operating personnel are not constantly working between them. Consider placing the quieter electronic units between the mechanical units. An effective method is to place quieter units at an angle to an aisle or an open work area.

Air conditioning blowers and other external noise sources, if not properly installed, can contribute substantially to the overall noise level. Duct work may conduct noise to or from other rooms. This can be reduced by acoustic treatment of the ducts.

Using absorptive materials reduces the overall sound level throughout an installation. For effective and economical sound reduction, use a sound absorptive ceiling. Satisfactory results can be expected from a false (dropped) ceiling. For large rooms, using absorptive material (such as carpet floor coverings) should result in further reduction of the sound level. To prevent computer room noise from reaching adjacent office areas, the walls should be constructed from the structural floor to the structural ceiling and be properly sealed. Doors should also have a good seal.

Acoustics (Noise-Emission Levels)

Acoustical data is intended to answer requests for information and is for consultants and planners requiring the data to help predict the levels of acoustical noise. The format in which the data is provided conforms to the standard used by the computer industry. The measurement procedures used to acquire the data conform to *American National Standard S12.10-1985* and *International Standard 7779*. The following terms are used to present acoustical data in this manual.

Noise emission levels for both 50 Hz and 60 Hz 4341/4381 Processors are identified on the individual specification pages.

Term	Definition
LwAd	The declared sound power-emission level.
LpAm	The mean value of the sound pressure emission levels at the operator position (if any).
<LpA>m	The mean value of the space-averaged sound pressure emission levels at the one-meter positions.
I	Impulsive noise.
T	Prominent discrete tones
N/A	Not applicable (no operator position).

Electromagnetic Compatibility

Data processing installations may be planned for areas having a high electromagnetic field environment. This occurs near a radio-frequency (rf) interference source (such as radio, TV, and RADAR transmitting antennas, or medical treatment equipment), and certain industrial equipment (such as rf induction heaters, rf arc welders, and insulation testers). For such conditions, consult IBM to determine whether any special installation or product considerations are advisable to ensure normal operation and maintenance.

The electromagnetic fields of transformers (such as within other units) may cause improper deflection within video displays, especially color displays. The recommended minimum distance between the display console and the processor is 1 meter (3.3 feet).

Lighting

Illumination of 540 to 800 lux (50 to 75 foot-candles), measured 760 millimeters (30 inches) above the floor, should be maintained.

Direct sunlight should be avoided because lower levels of illumination are needed to properly observe the various console and signal indicators. Also, direct sunlight may cause malfunction of devices that employ light sensing. General illumination should be sectionally controlled by switches so that portions of the lighting can be turned off as desired. Lights should not be powered from the computer power panel. See "Power Distribution System" on page 1-17.

Provision should be made for emergency lighting. See "Emergency Lighting" on page 1-21 and "Electrical Systems" on page 1-23.

Vibration

This information supplies vibration limits for IBM equipment. Some basic definitions concerning vibration are also given.

The vibration levels normally present in computer room and industrial installations are well within the indicated levels.

Some useful definitions of vibration for IBM products include:

Transient: Vibrations that are intermittent and do not cause a sustained resonant response in the IBM equipment.

Continuous: Vibrations that are present over an extended period and cause a sustained resonant response in the IBM equipment.

Shock: Shock is defined as those transient inputs that have a repetition rate that is slower than the time the IBM equipment needs to respond to it and return to a steady state condition.

Sinusoidal: Vibration with the characteristic shape of the classical sine wave (for example: 60 Hz ac power).

Displacement: Magnitude of the waveform; normally given in peak-to-peak displacement in English or metric units:

- Normally used to measure floor vibrations at low frequencies
- If the frequency is also known, displacement can be converted to "G" for a sine wave. "G" is the unit of acceleration caused by the force of gravity.

  Note: Many measuring instruments can convert displacement to "G" for either sinusoidal or complex waveforms.

Acceleration: Normally measured in "G" multiples of the acceleration because of the force of gravity. If the frequency is also known for a sine wave, acceleration can be calculated from displacement.

RMS: The long term ***average root mean square*** of the acceleration or amplitude values. Normally used as a measure of overall vibration for random vibration.

Peak: The maximum value of a sinusoidal or random vibration. This can be expressed as peak-to-peak in cases of sinusoidal vibration displacement.

If you need to make any calculations or require information regarding the above definitions, consult a mechanical engineer, a vibration consulting engineer, or your IBM representative.

The three classes of a vibration environment are:

- *V1* – Floor-mounted machines in an office environment
- *V2* – Table top and wall-mounted machines
- *V3* – Heavy industrial and mobile equipment.

A summary of the vibration limits for each of the three classes follows:

Class	Mils Peak-to-Peak 5-17 Hz	G 17-200 Hz	G 200-500 Hz
V1 C H	1.3	.021	.013
V1 T H	2.0	.035	.023
V1 C L	2.4	.04	.025
V1 T L	3.6	.06	.04
V2 C	5.2	.07	.036
V2 T	7.9	.11	.055
V3 C	30.0	.15	.075
V3 T *	37.1	.18	.09

Note: *Displacement-to-acceleration crossover frequency is 10 Hz instead of 17 Hz.

Where:

T = Transient

C = Continuous

G = Unit of acceleration caused by the force of gravity

H = Weight greater than 1500 pounds

L = Weight less than 440 pounds

Mils = English unit of .001 inch.

For Class V1 weights between 440 and 1500 pounds, use the following linear interpolation formula:

$$V = V_{440} - \frac{[(W - 440) \times (V_{440} - V_{1500})]}{1060}$$

Where:

V = Vibration level

V 440 = "G" or displacement at 440 pounds

W = Weight of machine in question

V 1500 = "G" or displacement at 1500 pounds.

The preceding vibration limits are based on worst-case actual field data for IBM systems. The environment normally met will not exceed these limits, except for abnormal cases involving construction, blasting, earthquakes, or direct impact.

The specified vibration limits are normally not exceeded under the following conditions:

- Continuous vibrations that are perceptible to humans, but are not annoying or distracting.
- Transient vibrations that are annoying or distracting, but not intolerable.

Note: If the actual levels are in doubt, have accurate measurements made by a qualified vibration or consulting engineer.

Air Conditioning

In determining the air conditioning capacity necessary, consider the following factors:

Equipment heat dissipation
Personnel heat dissipation
Latent load
Lighting
Fresh air introduction
Possible reheating
Heat conduction through outer walls
Ceiling
Floors
Door openings
Partitions
Glass wall area.

Computer room cooling is basically a sensible (as opposed to a latent) cooling operation.

Sensible heat is defined as the transfer of thermal energy to or from a substance resulting in a change in temperature. Latent heat is the thermal energy absorbed or evolved in a process, other than change of temperature. Most IBM equipment is air cooled by internal blowers. Most units are designed for updraft airflow. This must be considered when planning the air conditioning system and when laying out the floor plan for adjacent units. Unless noted on the individual specification pages, updraft airflow is used.

A separate air conditioning system is recommended for the data processing installation. Because of the amount of heat dissipated while the equipment is operating, the air conditioning system must provide year-round temperature and humidity control. Heat dissipation ratings are given on the specification page for each unit.

Air conditioning units should not be powered from the computer power panel. The feeder for the air conditioning system and the computer room power should not be in the same conduit.

Air Distribution and Types of Systems

The heat load of the computer equipment is concentrated in relatively small areas. Therefore, give attention to the method of air distribution to eliminate areas of excessive air motion.

The air conditioning system should use recirculated air with the introduction of a fixed minimum of fresh air for personnel. This fresh air permits pressurization of the area so that air leakage is always outward, which helps prevent entry of dust from adjacent areas.

Several types of air conditioning systems can be designed to satisfy the temperature and humidity requirements. The most common types of systems are described in the following text.

Overhead System

In this system, the entire heat load of the room (including the heat generated by the computer) is absorbed by the air supplied to the room. The air is generally supplied from either an overhead duct and diffuser system or a ceiling plenum.

The return air to the air conditioner is drawn either from ceiling return registers above the heat producing units, or from a fixed pattern of returns in the ceiling and/or in the walls around the room.

The temperature control system should consist of temperature and humidity controls placed in a representative location. A temperature and humidity recorder should be mounted adjacent to the controls to monitor the room conditions. See "Temperature and Humidity Recording Instruments" on page 1-16.

Underfloor System

In this system, the space between the building floor and the raised floor carries the supply of conditioned air. All air is discharged into the room through floor registers or perforated floor panels. The air returns by ceiling registers.

This system allows a higher air-return temperature without affecting the design conditions of the overall room.

This system takes into account a heat transfer factor through the raised floor.

The system must have air temperature controls for the underfloor supply system to prevent uncomfortably cold floor surfaces. The temperature and humidity of air entering the data processing equipment through cable openings must be within stated specifications.

Overhead/Underfloor System (Two Air Conditioning Systems)

One system with separate controls supplies conditioned and filtered air to the area under the raised floor. The air is discharged into the room through the floor panels or registers. This air absorbs most of the heat generated by the data processing units while they are in operation. Relative humidity of the air supplied to the units should be maintained within the range given on the specification pages for the units installed. Temperatures should be controlled to prevent condensation on or within the units.

The second air handling system supplies air directly to the room through overhead ducts. This system should be large enough to absorb the remaining heat load in the data processing area. It should be capable of maintaining room temperature and relative humidity as specified for the computer units when normal machine power is off, and be sized for year-round air conditioning, ventilation, and heating.

Temperature and Humidity Design Criteria

The data processing equipment can tolerate a considerable range of temperature and humidity, as described on the specification pages for each unit. An air conditioning system should be designed to maintain 24°C (75°F), and 50% relative humidity at altitudes up to 2 150 meters (7,000 feet). This design criteria provides for the largest buffer in terms of available computer operating time in case of air conditioning failure. In geographic areas where a design criterion of 50% relative humidity is not practical, use 45%.

If the air conditioning system fails, the computer can be operated until it reaches its specified limits. This increases the time available to repair the air conditioning system before the computer must be shut down. The design criteria have also proven to be a generally acceptable comfort level for personnel.

If deviations in either direction from the recommended design criteria are maintained for extended periods, the data processing equipment will be exposed to malfunctions from external conditions. This exposure increases as the deviation becomes larger. High relative humidity levels may cause improper feeding of cards or paper, as well as operator discomfort and condensation on windows and walls when the outside temperature falls below the room dew point. Low relative humidity levels alone do not cause static discharge. However, in combination with certain types of floor construction, floor coverings, furniture, etc., static charges generated by the movement of people, paper, or equipment are more readily stored. These charges may be high enough, if discharged by contact with another person or object, to be objectionable to operating personnel. If discharged to or near data processing equipment, these charges can cause intermittent machine malfunctions.

Because temperature and humidity deviations over only a few hours can permit the retention of static charge, the air conditioning system should be automatically controlled and be provided with a high/low alarm or a continuously recording device with appropriate limits marked.

In some areas, adding moisture to the room air is necessary to meet the design criteria. Some means of adding moisture are: steam grid or jets, steam cup, and water atomizers. To avoid contamination of the air, water treatment may be necessary in areas with high mineral content in the water.

In localities where the outside temperature drops below freezing, single-glazed windows permit condensation to form. If outside temperatures are considerably below freezing, the outside walls of the building should be waterproofed or vapor sealed on the inside. Otherwise, structural damage to the outside walls may occur.

For related information on the reduction of static electricity, see "Floor Construction" on page 1-5 and "Furniture" on page 1-7.

Operating Limits

Individual units have varying operating limits. To determine the operating limits for the complete equipment installation, refer to the specification pages for each unit.

When conditioned air is supplied near the base of any unit by a duct or underfloor supply, the maximum relative humidity of that air must not be greater than 80%. Air temperature in this duct or underfloor supply should be kept above the room dew point temperature to prevent condensation within or on the units.

The nonoperating range specifies a satisfactory environment when normal machine power is turned off, such as during off-shift hours.

Note: The air entering the units must be within the indicated ranges before power is turned on. Under no circumstances may the air entering the unit exceed the minimum or maximum operating temperature and humidity limits for any unit.

Certain units have downdraft cooling (see specification pages). When putting a unit with updraft cooling next to a unit with downdraft cooling, adhere to the recommended clearances and floor space requirements.

Air Filtration

A high-efficiency filter, rated according to the mechanical and electrostatic filter specifications given below, should be installed to filter all air supplied to the computer room. Because mechanical and electrostatic air cleaners operate on different principles, a different rating is specified for each type. Ratings are determined by using the test methods outlined in the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE), Standard No. 52-76 (or local or national equivalent).

Special air filtration is necessary where installations are exposed to corrosive gases, salt air, or unusual dirt or dust conditions.

Mechanical Air Filters

Mechanical air filters must be rated at a minimum of 20% efficiency. This rating applies to a clean filter and must be maintained throughout the life of the filter.

Electrostatic Plate Filter

Electrostatic plate filters must be rated at a minimum of 85 to 90% efficiency.

Electrostatic air cleaners are designed to operate at 85 to 90% efficiency at a given face velocity. As the face velocity through the filter increases, its efficiency decreases. Therefore, an electrostatic filter operated at increased face velocities, or below 85% efficiency, would allow a greater number of particles charged by the ionizing wires to pass through the plate section and enter the room. This would increase what is known as the space charge. As the space charge increases, a greater voltage differential occurs between the positive particles and the negative surfaces in the room. This causes dust to accumulate rapidly on all surfaces, and defeats the purpose of a high-efficiency filter.

Temperature and Humidity Recording Instruments

Temperature and humidity recording instruments are desirable and may be installed to provide a continuous record of temperature and humidity conditions in the area. If air conditioning requirements are not met, a record is then available to indicate the extent and duration of abnormal conditions.

It may be necessary to stabilize the equipment within the specified environmental limits before resuming operation.

The record of temperature and humidity conditions can be used to:

1. Make sure that the air conditioning system is operating properly.
2. Determine whether a mandatory temperature/humidity conditioning period is necessary. See "Storage of Data Recording Media" on page 1-23.

A visual or audible signal device should be included to indicate that temperature and/or humidity conditions are approaching the maximum limits. Taking timely corrective action may allow continuous operation. To monitor the appropriate room conditions, direct-reading instruments with a seven-day charting feature should be used for all installations. The recorder should be at a convenient location and adjacent to the air conditioning and humidity controls.

A remote indicating instrument is recommended for monitoring underfloor air conditions. This should also be a seven-day charting device and can be the wet-dry bulb or electronic type. The recording instrument can be in any location that is convenient to personnel responsible for maintaining air quality.

Relocation and Temporary Storage

IBM processors are designed for operation in a controlled temperature and relative humidity range, and even when stored or in shipment, require some environmental controls (see individual processor specifications).

Storage outside the specified limits can cause permanent damage. Care should also be taken to ensure that a unit is not stored with chemicals that can cause corrosion damage.

When a unit is removed from an installation in preparation for shipment or storage, it should undergo proper preparation by using the blocks, braces, preparation procedures, etc. found in the *Packaging Bill of Material.* This is a protective package designed uniquely for each unit, and is available from any IBM Branch Office. Processors should be shipped through a household goods carrier (padded van) with appropriate strapping and padding to avoid transit damage.

Power Requirements

A three-phase, five-wire power distribution system should be provided for flexibility in your data processing installation. However, depending on the types of equipment installed, a single-phase distribution system may be sufficient. The use of five wires enables you to provide power for three-phase or single-phase equipment. The five wires consist of three *phase* wires, one *neutral* wire, and one *insulated equipment ground* wire (green, or green with yellow trace).

The total power demand depends on the equipment configuration and the type of operation. A power summary can be derived by adding the kVA values shown on the individual unit specification pages. A more detailed analysis of power system requirements can be obtained by using the IBM System Power Profile Analysis. IBM can provide this analysis (based on your equipment configuration) showing the quantity, type, and model of each unit. This analysis also shows the power requirements, as well as the amount of heat dissipated.

Voltage Limits

Units included in a given system configuration may have different voltage tolerances. Review individual specification pages to determine the voltage tolerance for a specific system configuration. The steady-state and transient limits given in this section cover most combinations of IBM I/O equipment that can be attached to a processor.

To allow for various system configurations, the line-to-line, *steady-state* voltage tolerances when the equipment is operating must be maintained within plus 6% and minus 8% of the normal rated voltage, measured at the receptacle.

A *transient* voltage condition must not exceed plus 15% or minus 18% of normal rated voltage and must return within 0.5 seconds to a steady-state tolerance of plus 6% and minus 8%.

Because of the possibility of brownouts (planned voltage reduction by the utility company) or other marginal voltage conditions, it may be advisable to install a voltage monitor.

Frequency Limits

The line frequency must be maintained at 60 or 50 $\pm 1/2$ Hz (depending on the rating of the equipment).

Line-to-Line Voltage Imbalance

In a three-phase system, any line-to-line equipment voltage must not differ by more than 2.5% from the average of the three voltages. All three line-to-line voltages must be within the limits specified. See "Voltage Limits."

Harmonic Content

When the computer equipment is operating, the maximum total harmonic content of the power system voltage waveshapes on the equipment feeder must not exceed 5%.

Power Distribution System

This section addresses the requirements for electrical power distribution systems.

Primary Computer Power Service

For maximum reliability, the computer power panel should connect to feeders *that serve no other loads.*

Electrical noise producing devices, such as accounting equipment, card punch machines, typewriters, and desk calculators, should be connected to panels that are separate from those feeding the computer units.

Branch Circuits

The computer branch circuit panel should be in an unobstructed, well-lighted area in the computer room.

The individual branch circuits on the panel should be protected by circuit breakers properly rated according to manufacturer's specifications and applicable codes. Each circuit breaker should be labeled to identify the branch circuit it controls. The power requirements for I/O equipment are given on the unit specification pages in:

- *IBM Input/Output Equipment Installation Manual – Physical Planning for System/360, System/370, and 4300 Processors,* GC22-7064, or
- *IBM Input/Output Equipment Reference Installation Manual – Physical Planning for System/360, System/370, and 4300 Processors,* GC22-7069.

The grounding wire of the branch circuit must be insulated and equal in size to the neutral and phase conductors.

Terminate branch circuits as close as possible to the unit they supply—within 3 meters (10 feet). Run branch circuits in either rigid or nonrigid metallic conduit (or in compliance with local or national standards). The conduit system should be continuous, uninterrupted, and connected to the building or transformer ground (Figure 1-2 on page 1-19).

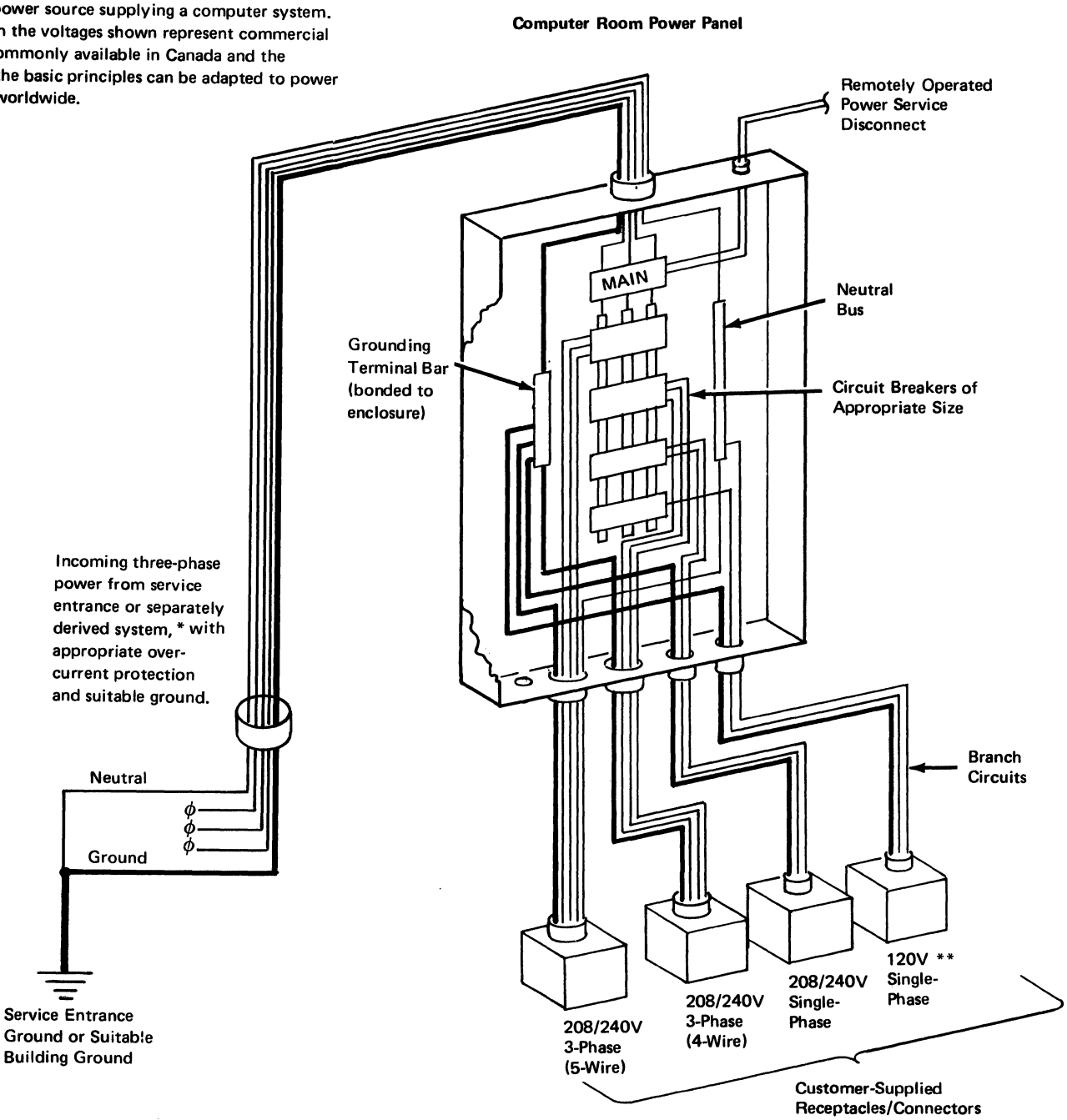
Power cords are shielded and 4.3-meters (14-feet) long, unless length is otherwise noted on the specifications page. The length is measured from the + symbol on the plan views. Power plugs furnished by IBM for the IBM 4300 Processors are watertight and can be located under the raised floor. Your receptacle should also be watertight and can be either an inline or a fixed type.

The plug on the power cord is approved for use with this machine and meets the relevant testing laboratory or country/test-house standards.

Please see **Plugs/Branch Circuits, Power Distribution System, Chapter 1** *in* **Appendix H** *for a translation of the following notice.*

CAUTION:
For the user's safety, in countries where a plug is used, the plug must be connected to a properly wired and grounded receptacle. An improperly wired receptacle could place a hazardous voltage on accessible metal parts of the machine and on the metal housing of the plug and receptacle. The customer is responsible for receptacle wiring.

This diagram shows the elements of a reliable design for the power source supplying a computer system. Although the voltages shown represent commercial power commonly available in Canada and the U.S.A., the basic principles can be adapted to power sources worldwide.


Computer Room Power Panel
Remotely Operated Power Service Disconnect
MAIN
Neutral Bus
Grounding Terminal Bar (bonded to enclosure)
Circuit Breakers of Appropriate Size
Incoming three-phase power from service entrance or separately derived system, * with appropriate over-current protection and suitable ground.
Neutral
Ground
Service Entrance Ground or Suitable Building Ground
Branch Circuits
208/240V 3-Phase (5-Wire)
208/240V 3-Phase (4-Wire)
208/240V Single-Phase
120V ** Single-Phase
Customer-Supplied Receptacles/Connectors in Accordance with Local Codes
Legend:
Phase Wires and Neutral
Insulated Green Wire Ground

*A separately derived system is a premises wiring system whose power is derived from generator, transformer, or converter windings and has no direct electrical connection to suppy conductors originating in another system.

** For loads requiring a neutral. Attach computer/data processing equipment only.

Figure 1-2. Power Distribution Systems

Grounding

All IBM units are provided with an equipment ground wire (green or green with yellow trace). At the branch circuit panels, the equipment grounding conductor from all units must be connected to one main grounding conductor. This insulated equipment grounding wire is a dedicated ground, not a neutral, and must be carried back to the service ground or suitable building ground. Conduit must not be used as the only grounding means. All attachment-plug receptacles used to connect the unit or system and interconnected equipment to the unit or system are all to be of a grounding type. The grounding conductors servicing these receptacles are to be grounded to earth ground at the service equipment, or a suitable ground in accordance with the National Electrical Code.

Phase Rotation

The three-phase power receptacles for the computer (if required) must be wired for correct phase rotation. When you look at the face of the receptacle and count (clockwise) from the ground pin, the sequence is: phase 1, phase 2, and phase 3.

Computer Room Emergency Power-Off Controls

As a safety precaution, room emergency power-off controls should be provided for disconnecting the *main service wiring* supplying the computer equipment. These controls should be located at a convenient place for the operator and next to the main exit doors of the room.

Lightning Protection

It is recommended you should install lightning protection devices when:

- Primary power is supplied by an overhead power service.
- The utility company installs lightning protectors on the primary power source.
- The area is subject to electrical storms or equivalent-type power surges.

You are responsible for the selection and installation of lightning protection devices.

Convenience Outlets

A suitable number of convenience outlets should be installed in the computer room and the CE area for use by building maintenance personnel, service representatives, etc. Convenience outlets should be on the lighting or other building circuits, not on the computer power panel or feeder. For detailed requirements, see "Customer Engineering Support Facilities" on page 1-27. Under no circumstances are the service convenience outlets on IBM units to be used for any purpose other than normal servicing.

Primary Power Problem Areas

IBM equipment operates satisfactorily on the normal power supplied by most power companies. However, many outside variables exist over which neither the power company nor IBM has any control. Possible computer malfunctions can be caused by outside (radiated or conducted) transient electrical noise signals being superimposed on the power to the computer. To guard against this, power distribution design should comply with that specified in this manual.

Failures caused by the power source are basically of two types:

1. **Power outages:** These include short duration dips in voltage as well as prolonged outages. If the frequency of such power failures is not acceptable for your operation, installing standby and/or buffered power may be necessary.
2. **Transient electrical noise superimposed on power lines:** This may be caused by a variety of industrial, medical, communications, or other equipment in the vicinity of the power company's distribution lines, or within or adjacent to the computing facilities. Motor-operated devices on the same power source as the computer may, under certain conditions, cause intermittent electrical disturbances.

Safety and Fire Precautions

Safety is a vital factor in planning a computer installation. This should be reflected in the choice of the computer location, building materials used, fire detection and protection equipment, air conditioning and electrical systems, and personnel training.

Emergency Lighting

You should make provisions for emergency lighting. Requirements for emergency lighting may be found in NFPA No. 75-1976 (or the local or national equivalent).

Computer Location

1. The computer should be located in a fire-resistive building or room.
2. The computer room should not be above, below, or adjacent to areas where hazardous materials or gases are stored, manufactured, or processed. If it must be located near such an area, take appropriate precautions.

Fire Prevention Considerations

1. Walls enclosing a data processing area should be of noncombustible materials (minimum of one-hour fire resistance rating). These walls should extend from the structural floor to the structural ceiling.
2. If a false (dropped) ceiling is to be added, it should be constructed of noncombustible or fire-resistant material. If combustible materials are used in the space between the structural ceiling and the false ceiling, provide appropriate fire protection. All ducts and insulating materials should be noncombustible and nondusting.
3. A raised floor, installed over the structural floor, should be constructed of noncombustible or fire-resistant materials. If the structural floor is of combustible material, it should be protected, preferably by water sprinklers.

   Note: Before the computer is installed, the space between the raised and the structural floors should be cleared of debris. To keep it free of accumulated dust and debris, this space should be periodically checked after installation.
4. The roof or floor above the computer and recorded media storage areas should be watertight.
5. Drainage for the subfloor space should be provided. In buildings where the computer room structural floor is recessed and the raised surface is on the level of adjacent areas, proper drainage must be installed under the raised floor as a precaution against flooding or water accumulation.

Computer Area Fire Prevention Equipment

1. An early-warning detection system should be installed to protect the computer and recorded media storage areas. It should actuate an audible alarm in the computer room and at a monitored central station.
2. Portable carbon dioxide fire extinguishers of suitable size and number should be provided for use on the electrical equipment.
3. Portable, pressurized, water extinguishers should be provided for ordinary combustible material, such as paper.
4. Extinguishers should be readily accessible to individuals in the area. Extinguisher locations should be clearly marked overhead.
5. Where portable cylinders are used as the primary extinguishing agent, a standpipe or hose unit (as a secondary or backup extinguishing agent) should be located within effective range of the computer areas.
6. If a Halon 1301[1] (or equivalent) gas room flooding system is installed, see NFPA No. 12A (or applicable local or national equivalent). When the room is occupied, an appropriate time delay (from the time of detection to the time of discharge) should be installed in conjunction with a manual override switch. The time delay should be sufficient for the evacuation of all personnel from the area.
7. Where automatic water sprinklers are required because of building conditions, automatic on/off sprinklers should be considered if they satisfy local fire protection codes. This type of system minimizes the quantity of water discharged that could otherwise cause additional damage.
8. Metal waste material containers with flame-suppressant lids should be used.

Data Storage

1. Any data stored in the computer room, whether in the form of magnetic tape, paper tape, cards, paper forms, etc., should be limited to the minimum needed for safe, efficient operation. When not in use, this data media should be stored in metal cabinets or fire-resistant containers.
2. For security purposes and for protection against fire, a separate storage room is recommended. The room should be constructed of fire-resistant material (minimum two-hour fire resistance rating). The preferred type of fire prevention equipment is a sprinkler system or a gas room flooding system.

Supporting Facilities

Consider air conditioning and electrical systems when planning for safety and fire protection.

Air Conditioning Systems

1. When the data processing area is supplied by a *dedicated* air conditioning system, it should be controlled by the room emergency power-off switches.

   When the regular building air conditioning system is used with *supplemental* units in the computer room, the supplemental units should be controlled by the room emergency power-off switches.

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[1] Trademark of E.I. duPont de Nemours & Co., Inc.

Room emergency power-off switches should be placed near the operator's console and also next to the main exit doors.

2. Air ducts that serve other areas and pass through the computer room should have fusible-link dampers, as prescribed by local code.
3. The air filters should be of noncombustible or self-extinguishing material.

Electrical Systems

1. Where continuity of operation is essential, a standby and/or buffered power source should be installed.
2. An automatic battery-operated lighting system should be installed in case of power or lighting circuit failure. These units are controlled by the lighting circuit.
3. Watertight connectors should be used under raised floors.

Preplanning to Continue Operation in an Emergency

Continued operation depends on the information stored on cards, tapes, disks, drums, and so forth, and on the equipment used to process the information. Arrangements should be made for emergency use of other equipment and the transportation of personnel, data, and supplies to a temporary location. Duplicates of master records should be maintained in a remote area.

General Precautions and Personnel Training

1. The computer room, air conditioning equipment room, and data storage room should be continuously monitored.
2. Plumbing above the false ceiling should be periodically inspected.
3. Emergency exit doors should be provided in the data processing area and be clearly identified. The number of doors depends on the size and location of the data processing area, and on local fire codes.
4. Personnel should be trained in emergency measures, such as:
   a. Method and sequence of shutting off all electrical power
   b. Shutting off air conditioning systems
   c. Calling fire company
   d. Handling fire extinguishers and small diameter fire hoses
   e. Evacuating records
   f. Evacuating personnel
   g. Administering first aid.

Additional Reference Material

Consult NFPA Standard No. 75, *Protection of Electronic Computer/Data Processing Equipment* (or applicable local or national equivalent).

Storage of Data Recording Media

This section describes provisions to safeguard data recording media.

Magnetic Tape

Storage conditions for magnetic tape should be maintained within the following limits:

Temperature: 4 to 32°C (40 to 90°F)
Relative Humidity: 20 to 80%
Maximum Wet Bulb: 27°C (80°F).

Tape must be conditioned by placing it in the operating environment for 24 hours before use. The operating environment for tape is:

Temperature: 16 to 32°C (60 to 90°F)
Relative Humidity: 20 to 80%
Maximum Wet Bulb: 26°C (78°F).

The individual machine specification pages should be reviewed because some units may require special considerations and have more or less restrictive requirements.

The tape should be stored in a vertical position in a dustproof container and should never come in contact with magnetic material at any time. Magnetic fields of greater than 40 A/cm (50 oersteds) can cause the loss of information or the introduction of noise.

When shipping magnetic tape, each reel should be sealed in a plastic bag and packed individually in a stiff cardboard shipping box.

For more detailed handling, storage, and operating information about magnetic tape, see *Tape Specifications for IBM One-Half Inch Tape Units at: 556, 800, 1600 and 6250 BPI,* Order No. GA32-0006.

Disk Pack, Disk Cartridge, Data Cell, and Data Modules

Storage facilities for these data media should be maintained within the following limits:

Disk Pack, Disk Cartridge, and Data Module Storage:

Short-Term Storage:
Temperature: 16 to 32°C (60 to 90°F)
Relative Humidity: 10 to 80%

Intermediate-Term Storage:
Temperature: 4 to 66°C (40 to 150°F)
Relative Humidity: 10 to 80%.

Data Cell Storage:

Temperature: 10 to 43°C (50 to 110°F)
Relative Humidity: 8 to 80%
Maximum Wet Bulb: 27°C (80°F).

Any such media exposed to conditions outside these limits must be conditioned by placing them in the operating environment for a period equivalent to the exposure. (It is not necessary to condition these media for more than two hours.)

These media have dustproof covers that should be left in place, except when installed in the drive. Storage should be in fire-resistant cabinets away from magnetic fields.

Magnetic fields of greater than 40 A/cm (50 oersteds), or 20 A/cm (25 oersteds) for 3348 Data Module Model 70F, can cause loss of information or introduction of noise.

Additional information concerning handling, operation, device dimensions, flammability characteristics, shipping requirements, and housekeeping is in:

- *IBM Disk Pack and Cartridge Handling and Operating Procedures,* Order No. GA26-5756
- *IBM Data Cell Handling Guide,* GA26-3633
- *IBM Data Module Handling and Operating Procedures,* GA26-1625.

Data Cartridge

The data cartridge is normally stored within the IBM 3851 Mass Storage Facility. Storage conditions at the 3851 air input, or in supplemental (nonoperating) storage areas, should be maintained within the following limits:

Temperature: 4 to 32°C (40 to 90°F)
Relative Humidity: 8 to 80%
Maximum Wet Bulb: 21°C (70°F).

Exposure of the cartridge to elevated temperatures for extensive periods can cause physical deformation of the medium. Exposure of the cartridge to temperatures above 32°C (90°F), below 16°C (60°F), or to other conditions outside the above limits necessitates conditioning before use.

When exposed to conditions outside these limits, this medium must be conditioned by placing it in the operating environment for a period equivalent to the exposure. (It is not necessary to condition this medium for more than 24 hours.)

Your storage facilities should be fire-resistant enclosures located away from magnetic fields. Magnetic fields of greater than 24 A/cm (30 oersteds) can cause the loss of data or the introduction of noise.

Additional information concerning handling, operation, device dimensions, flammability characteristics, shipping requirements, and housekeeping is in the *Component Description* publications for data cartridge devices and in *IBM Disk Pack and Cartridge Handling Procedures,* Order No. GA26-5756.

Channel Priority

Performance can usually be improved by prioritizing channel-attached input/output equipment. Channel priority is beyond the scope of this manual. It is mentioned as a reminder that this important task must be addressed together with other physical planning considerations. Refer to:

- *IBM 4341 Processor Model Groups 1, 9, and 10 Channel Characteristics,* GA24-3671
- *IBM 4341 Processor Model Groups 2, 11, and 12 Channel Characteristics,* GA24-3780
- *IBM 4381 Processor Channel Characteristics,* GA24-3948
- *IBM 4321/4331/4341/4361 Processors Summary and Input/Output & Data Communications Configurator,* GA33-1523.
- *IBM 4381 Processor Summary and Input/Output & Data Communications Configurator,* GA24-3950.

Cables

IBM supplies the necessary cables for the initial installation as shown on the specification pages. Cables must be ordered by starting at the unit most remote from the processor. Cables are then specified from unit to unit, back to the processor. The proper sequence must be observed to ensure receiving the right length cables. Because cables are custom-made to the lengths required, they must be measured in accordance with the approved layout. The group number and channel (where required), along with the required cable length must be submitted for each cable in the equipment layout. The required cable length is defined as the center-to-center distance between unit cable entry holes measured along the intended route of the cable as projected on the floor or other mounting surface.

When units are mounted on a raised floor, twice the height of the raised floor should be included in the required cable length. IBM makes allowance for the portion of each cable that is from the floor or mounting surface into the unit. For the best electrical design and computer performance, all cable lengths should be as short as possible. External interconnecting cables should be installed under the raised floor. Where a raised floor is not used, cables should be protected from mechanical damage and installed so as not to be a safety hazard.

Requests for cables that exceed the maximum lengths specified for the equipment must be approved by IBM and may be subject to additional charges. For timing considerations regarding cable ordering, see "Scheduling the Installation" on page 1-1.

When a unit requires external cables that must be installed through walls and/or floors, the ordering and installation arrangements should be made with sufficient lead time to permit the cable facilities to be available to the computer equipment at system installation time. This pertains to such units as display stations and communication devices.

Cables Related to Initial Installations

The cable or cable group required to install units from IBM is supplied by IBM at no additional charge to the customer, provided that the cable:

1. Is within standard specifications
2. Is in accordance with an approved layout and
3. Is not identified as a customer-supplied or chargeable item.

Changes in cable-order specifications requested within two months of the scheduled shipment date (or as the result of any non-IBM-caused deferment) may be subject to additional charge(s). Cables (of the type provided at no additional charge for an initial installation) changed to accommodate the installation of additional IBM units are supplied by IBM at no charge. An explanation of why the cables are required must accompany the cable order. All replaced cables remain the property of the owner of the IBM machine.

Other Cables

You may be subject to additional charges for cables that:

- Connect IBM and non-IBM equipment
- Are rearranged, or
- Are replaced for the installation of units not delivered from IBM.

You may supply your own coaxial signal cables or purchase them from IBM. For cable specifications and ordering information, refer to the appropriate *Installation Manual – Physical Planning* for the peripheral device being installed. For coaxial cable installation information, refer to *Installation and Assembly of Coaxial Cable and Accessories for Attachment to IBM Products,* GA27-2805.

Customer Engineering Support Facilities

The need for a service area and for on-site test equipment varies according to the size of the IBM installation and the number of IBM service personnel required. Provision for these facilities must be negotiated locally.

IBM will assist in the preparation of a scaled layout and help in locating the equipment, receptacles, lights, and so forth in the service area. This area should contain a convenience outlet not powered from the computer power panel.

The *IBM Physical Planning Template: Field Engineering Furniture and Test Equipment,* GX22-6925, is available to assist in planning this area.

Remote Support Facility and Remote Operator Console Facility

The Remote Support Facility (RSF) feature allows a communication link between the 4300 Processor and a support facility with a maintenance data bank.

The four modes of operation are:

1. **Data Bank Mode** allows an IBM service representative to access the support facility from the processor site.
2. **Remote Console Mode** allows remote control by a support facility specialist from an IBM remote service terminal.
3. **Problem Analysis Mode** allows you to transmit machine log data to the support facility and to receive patches.
4. **Remote Operator Console Facility (ROCF) Mode** uses RSF hardware and allows you to operate your system console from a remote location with the appropriate site programming and hardware capabilities.

If you have ordered either RSF or ROCF, you must provide the common-carrier facilities as required by the ordered feature. See Appendix D, "Communication Lines" on page D-1.

Note: Feature 9514 provides a special exclusion-key telephone set with the processor. The customer is responsible for unpacking, assembling, and connecting this IBM-supplied telephone.

Outside the United States and Canada, the connection of the RSF/ROCF feature varies for different countries:

- PTT interface for acoustic couplers (EIA/CCITT V.24/V.28).
- Switched network termination for line plate interface.
- PD1-A (NCU MM 2 couplers) for Japan and NTT interface.

Manual operation requires using an exclusion-key telephone to dial or answer the call. This telephone is generally called a 503-type (rotary dial), exclusion key telephone. The circuit is switched to the modem to permit data transfer.

You must provide the telephones[2] that plug into the modular jacks[3] that terminate the switched network lines for Features 9510, 9511, and 9512. Feature 9514 provides the telephone with the processor.

In the U.S.A., each telephone, modem, and protective coupler used on the public switched network must be registered with the FCC. When communication facilities are ordered, you must specify, by their Universal Service Order Code (USOC), the jack(s) required to terminate the line. (See Features 9510, 9511, 9512, and 9514 in Appendix D.) For each device to be directly attached to the switched network, you must provide the telephone company with specific registration information for each device; this information is provided by the manufacturer or supplier of the device.

In the U.S.A., the coupler vendor (or distributor) provides:

1. The FCC registration number of the coupler
2. The ringer equivalency number (REN) for the coupler.

The switched network facilities are terminated in a USOC RJ36X series jack into which the exclusion-key telephone is plugged, except for Feature 9514, which requires a USOC RJ11 series jack. (See Appendix D, "Communication Lines" on page D-1.) For the programmed-type attachment, the series jack, with leads from the exclusion-key telephone, are wired to a USOC RJ45S data jack.

The modem or coupler can use a fixed-loss (FLL) loop type of attachment that requires a USOC RJ41S data jack or, if installed after a PBX (Private Branch Exchange) using a permissive attachment, a USOC RJ16X voice jack. For proper operation, the jack installed must be as specified and registered with the FCC (in the U.S.A.) by the modem or coupler manufacturer.

When the exclusion-key telephone is ordered for Features 9510, 9511, and 9512, some optional features must be specified. A verbal description of the options should be enough to specify the options to the telephone supplier. See Appendix D, "Communication Lines" on page D-1. The telephone set provided with Feature 9514 has the required options already installed.

In the U.S.A., the Federal Communications Commission (FCC) Part 68 and regulations (in effect July 1979) also affects customer premises equipment (CPE), such as telephones and modems. Now all CPEs attached to the public-switched telephone network must be registered with the FCC. The FCC also requires that a protective coupler be provided to protect the switched network. Most modems include the pro-

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[2] Available through a telephone equipment supplier or provided by IBM with Feature 9514.

[3] Communication line available through a communications common carrier (telephone company).

tective coupler within the modem. Some other configurations use an external device, called a *data protective coupler,* inserted between an unprotected modem and the switched network interface.

For the data line, order a switched network line for data up to 1200 BPS and request that the line be terminated with modular jacks. See Appendix D, "Communication Lines" on page D-1.

Standard Shipping Dimensions and Environmental Specifications

1. For shipping dimensions, refer to the unit's specification pages.
2. The following environmental specifications apply:

   Temperature: -40 to 60°C (-40 to 140°F)
   Relative Humidity: 5 to 100% (no condensation or rain)
   Maximum Wet Bulb: 1 to 29°C (33 to 85°F).

Metric Conversions

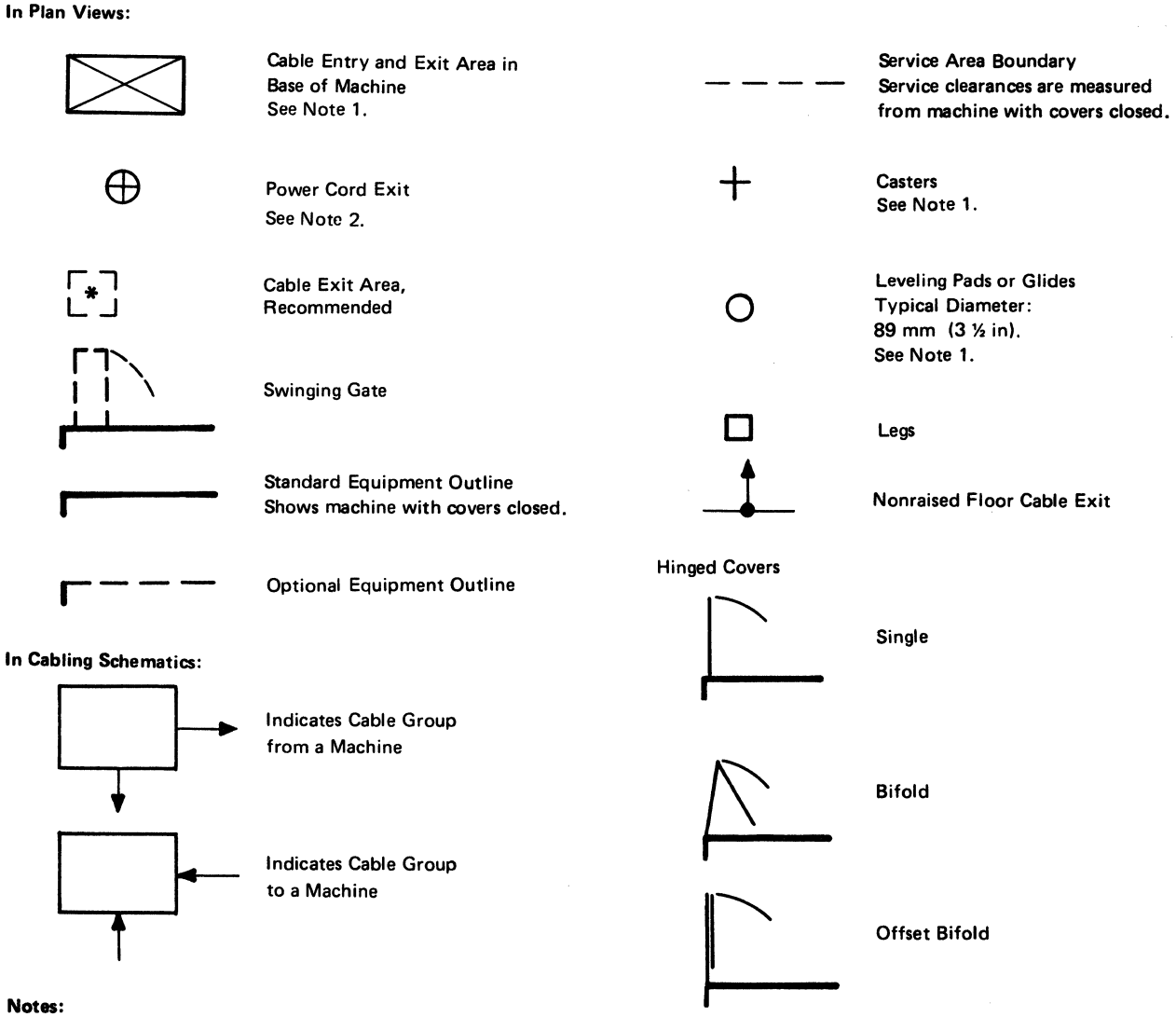
Values expressed in metric notation use a space to separate hundreds from thousands, and a period to separate whole numbers from decimal fractions. For example, two thousand one hundred kilograms is expressed as 2 100 kg and one-half kilogram is 0.5 kg.

In this manual, English units converted into metric units are rounded to the nearest whole number or to the nearest decimal place given. Exceptions are kilograms (kg), cubic meters per minute (m^3/min), kilograms per square meter (kg/m^2) pertaining to floor loading, and meters (m) pertaining to altitude. These are rounded according to the "1/10/50" rule:

1. A number less than 100 is rounded up to the next whole unit; for example, 23.2 becomes 24.
2. A number greater than 100 and less than 1 000 is rounded up to the next ten; for example, 163 becomes 170.
3. A number greater than 1 000 is rounded up to the next 50; that is, 1 218 becomes 1 250.

Symbols Used in Plan Views

Figure 1-3 shows the standard symbols used in plan views. Frame numbers are shown circled on plan views and schematics.


In Plan Views:
Cable Entry and Exit Area in Base of Machine See Note 1.
Power Cord Exit See Note 2.
Cable Exit Area, Recommended
Swinging Gate
Standard Equipment Outline Shows machine with covers closed.
Optional Equipment Outline
In Cabling Schematics:
Indicates Cable Group from a Machine
Indicates Cable Group to a Machine
Service Area Boundary Service clearances are measured from machine with covers closed.
Casters See Note 1.
Leveling Pads or Glides Typical Diameter: 89 mm (3 ½ in). See Note 1.
Legs
Nonraised Floor Cable Exit
Hinged Covers
Single
Bifold
Offset Bifold

Notes:

1. *Unless otherwise noted, locating dimensions are measured from edge of frame, not cover.*
2. *Power cords are supplied in 4.3 m (14-foot) lengths unless otherwise noted on the specification page. The length is measured from the symbol* ⊕.

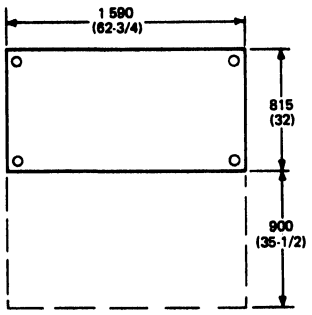
Figure 1-3. Standard Symbols

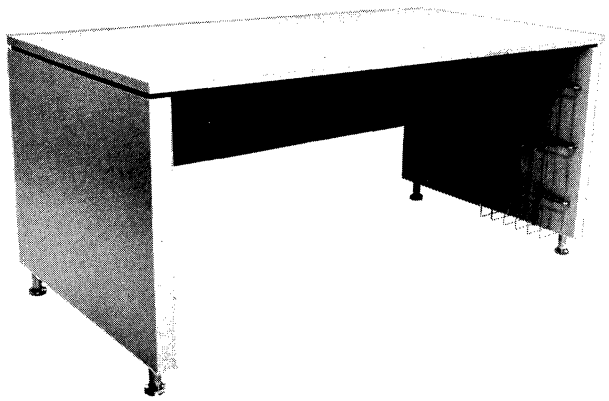
Chapter 2. Processor Specifications and Cabling Schematics

Console Table (Optional)

Plan View (Metric Scale: 20 mm = 1 m)

English measurements are shown in parentheses.





Console Table (Feature 1550) shown with Book Rack and Cable Holder (Feature 1480). Up to four Book Rack and Cable Holders can be installed on a Console Table (1550).

Specifications

Dimensions:

	Front	*Side*	*Height*
mm	1 590	815	735
(inches)	(62-3/4)	(32)	(29)

Service Clearances:

	Front
mm	900
(inches)	(35-1/2)

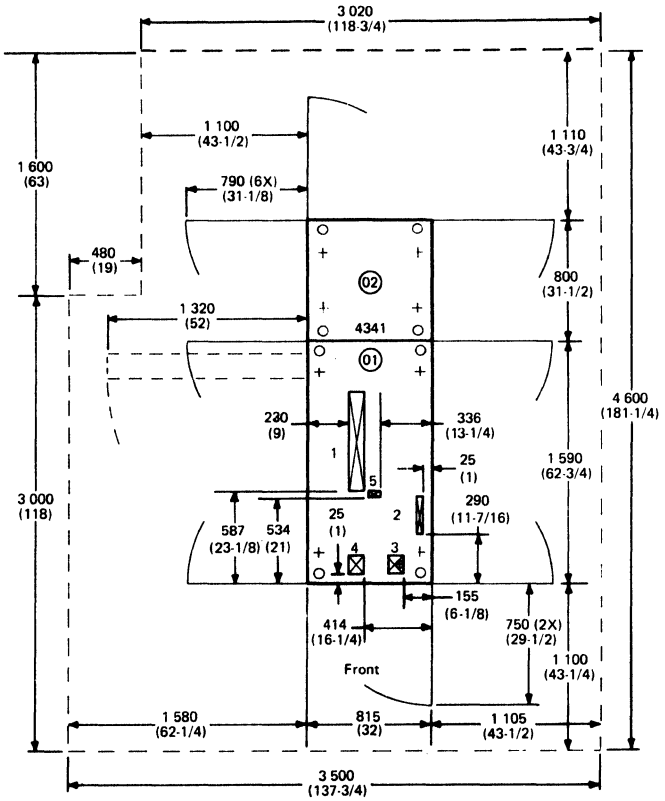
Weight:

kg	200
(lb)	(125)

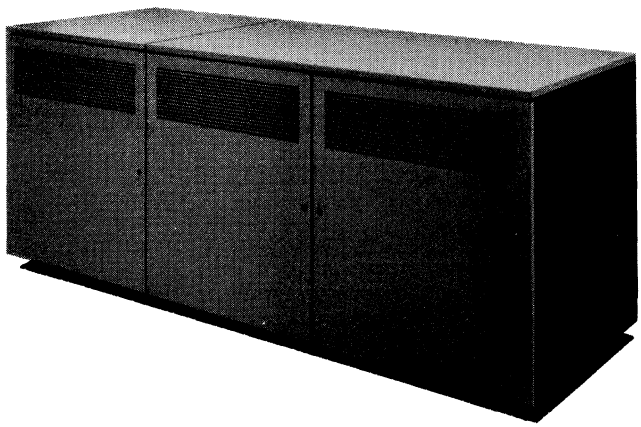
IBM 4341 Processor

Plan View (Metric Scale: 20 mm = 1 m)

English measurements are shown in parentheses.



Cable Entry/ Exit Number	Dimensions (See Note 3)	
	Millimeters	Inches
1	110 x 665	4 x 26
2	40 x 270	1-1/2 x 10-1/2
3	100 x 130	4 x 5
4	100 x 130	4 x 5
5	85 x 55	3-1/2 x 2



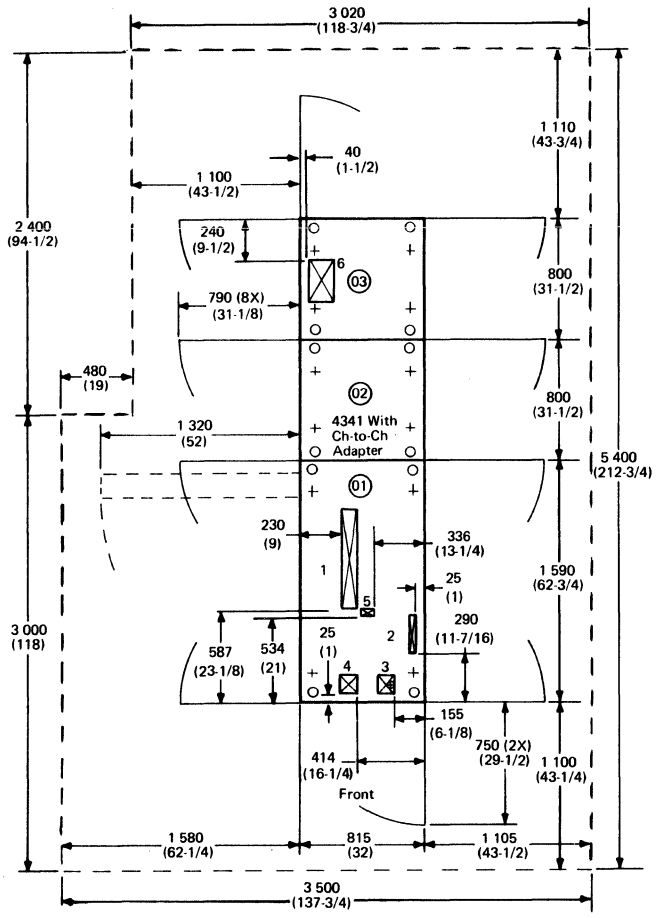
Notes:

1. A console table is available from IBM as an optional feature.
2. Entry/exit holes are measured from edge of frame, not the covers.
3. Cable entry/exit holes shown represent locations on the machine and do not necessarily represent or require a corresponding hole in the floor. Cables from more than one entry/exit hole may be consolidated in a given hole in the floor. If this is done, allow for the additional cable length that may be required.
4. Because the machine does not have skirts, cable exit points in nonraised-floor installations are restricted only by the location of the casters.

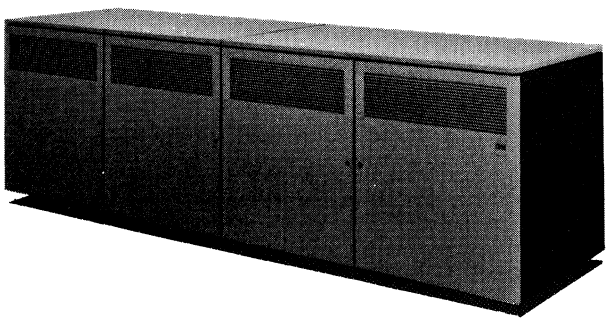
IBM 4341 Processor With Channel-to-Channel Adapter

Plan View (Metric Scale: 20 mm = 1 m)

English measurements are shown in parentheses.



Cable Entry/ Exit Number	Dimensions (See Note 3)	
	Millimeters	Inches
1	110 x 665	4 x 26
2	40 x 270	1-1/2 x 10-1/2
3	100 x 130	4 x 5
4	100 x 130	4 x 5
5	85 x 55	3-1/2 x 2
6	155 x 280	6 x 11



Notes:

1. A console table is available from IBM as an optional feature.
2. Entry/exit holes are measured from edge of frame, not the covers.
3. Cable entry/exit holes shown represent locations on the machine and do not necessarily represent or require a corresponding hole in the floor. Cables from more than one entry/exit hole may be consolidated in a given hole in the floor. If this is done, allow for the additional cable length that may be required.
4. Because the machine does not have skirts, cable exit points in nonraised-floor installations are restricted only by the location of the casters.

IBM 4341 Processor Model Groups 1, 9, 10, and 11 Specifications

Dimensions:

Basic Processor:

	Front	*Side*	*Height*
mm	815	2 390	1 000
(inches)	(32)	(94-1/4)	(39-1/2)

With CTCA:

	Front	*Side*	*Height*
mm	815	3 190	1 000
(inches)	(32)	(125-3/4)	(39-1/2)

Covers Removed—Frame 01:

	Front	*Side*	*Height*
mm	750	1 525	975
(inches)	(29-1/2)	(60)	(38-1/2)

Covers Removed—Frame 02 or 03:

	Front	*Side*	*Height*
mm	750	760	975
(inches)	(29-1/2)	(30)	(38-1/2)

Service Clearances:

Basic Processor:

	Front	*Rear*	*Right*	*Left*
mm	1 100	1 100	1 100	1 580
(inches)	(43)	(43)	(43)	(62)

Weight:

	Frame 01	*Frame 02*	*Frame 03*	*Total*
kg	545	270	185	1 000
(lb)	(1,200)	(590)	(400)	(2,190)

Heat Output:

Basic 4 050 Watts (13,800 BTU/hr)
With CTCA 4 400 Watts (15,000 BTU/hr)

Airflow (downdraft):

Basic 37 m^3/min (1,300 cfm)
With CTCA 44 m^3/min (1,550 cfm)

Power Requirements:

	50 Hz	*60 Hz*
kVA	5.6	4.4
With CTCA	6.0	4.8
Phase	3	3

Voltages:

	Nominal	*Minimum*	*Maximum*
50 Hz	200	180	220
	220	193	238
	380	333	410
	400	350	432
	415	363	448
60 Hz	200	180	220
	208	180	220
	220	193	238
	240	208	254

Power Cord:

meters 4.3 [optional, 1.8]
(feet) (14) [optional, 6]

Power Cord Style: D1 (See Appendix B.)

U.S.A. and Canada:

Plug R&S, 3760 (IBM Provided)
Receptacle R&S, 3754 (Customer Provided)
Connector R&S, 3934 (Customer Provided)

Noise Emission Levels

For definitions see "Acoustics (Noise-Emission Levels)" on page 1-9.

	LwAd		**< LpA > m**	
	Operating	**Idling**	**Operating**	**Idling**
Hz	**(bels)**	**(bels)**	**(db)**	**(db)**
60	7.3	7.3	56.0	56.0
50	7.1	7.1	58.0	58.0

Operating Environment:

Temperature: 10-32°C (50-90°F)
Relative Humidity: 8-80%
Maximum Wet Bulb: 23°C (73°F)

Nonoperating Environment:

Temperature: 10-43°C (50-110°F)
Relative Humidity: 8-80%
Maximum Wet Bulb: 27°C (80°F)

IBM 4341 Processor Model Groups 2 and 12 Specifications

Dimensions:

Basic Processor:

	Front	*Side*	*Height*
mm	815	2 390	1 000
(inches)	(32)	(94-1/4)	(39-1/2)

With CTCA:

	Front	*Side*	*Height*
mm	815	3 190	1 000
(inches)	(32)	(125-3/4)	(39-1/2)

Covers Removed—Frame 01:

	Front	*Side*	*Height*
mm	750	1 525	975
(inches)	(29-1/2)	(60)	(38-1/2)

Covers Removed—Frame 02 or 03:

	Front	*Side*	*Height*
mm	750	760	975
(inches)	(29-1/2)	(30)	(38-1/2)

Service Clearances:

Basic Processor:

	Front	*Rear*	*Right*	*Left*
mm	1 100	1 100	1 100	1 580
(inches)	(43)	(43)	(43)	(62)

Weight:

	Frame 01	*Frame 02*	*Frame 03*	*Total*
kg	603	317	185	1 105
(lb)	(1,330)	(700)	(400)	(2,430)

Heat Output:

Basic 4 800 Watts (16,400 BTU/hr)
With CTCA 5 150 Watts (17,600 BTU/hr)

Airflow (downdraft):

Basic 37 m^3/min (1,300 cfm)
With CTCA 44 m^3/min (1,550 cfm)

Power Requirements:

	50 Hz	*60 Hz*
kVA	6.4	5.3
With CTCA	6.8	5.7
Phase	3	3

Voltages:

	Nominal	*Minimum*	*Maximum*
50 Hz	200	180	220
	220	193	238
	380	333	410
	400	350	432
	415	363	448
60 Hz	200	180	220
	208	180	220
	220	193	238
	240	208	254

Power Cord:

meters 4.3 [optional, 1.8]
(feet) (14) [optional, 6]

Power Cord Style: D1 (See Appendix B.)

U.S.A. and Canada:

Plug R&S, 3760 (IBM Provided)
Receptacle R&S, 3754 (Customer Provided)
Connector R&S, 3934 (Customer Provided)

Noise Emission Levels

For definitions see "Acoustics (Noise-Emission Levels)" on page 1-9.

	LwAd		**<LpA>m**	
	Operating	**Idling**	**Operating**	**Idling**
Hz	**(bels)**	**(bels)**	**(db)**	**(db)**
60	7.3	7.3	56.0	56.0
50	7.4	7.4	58.0	58.0

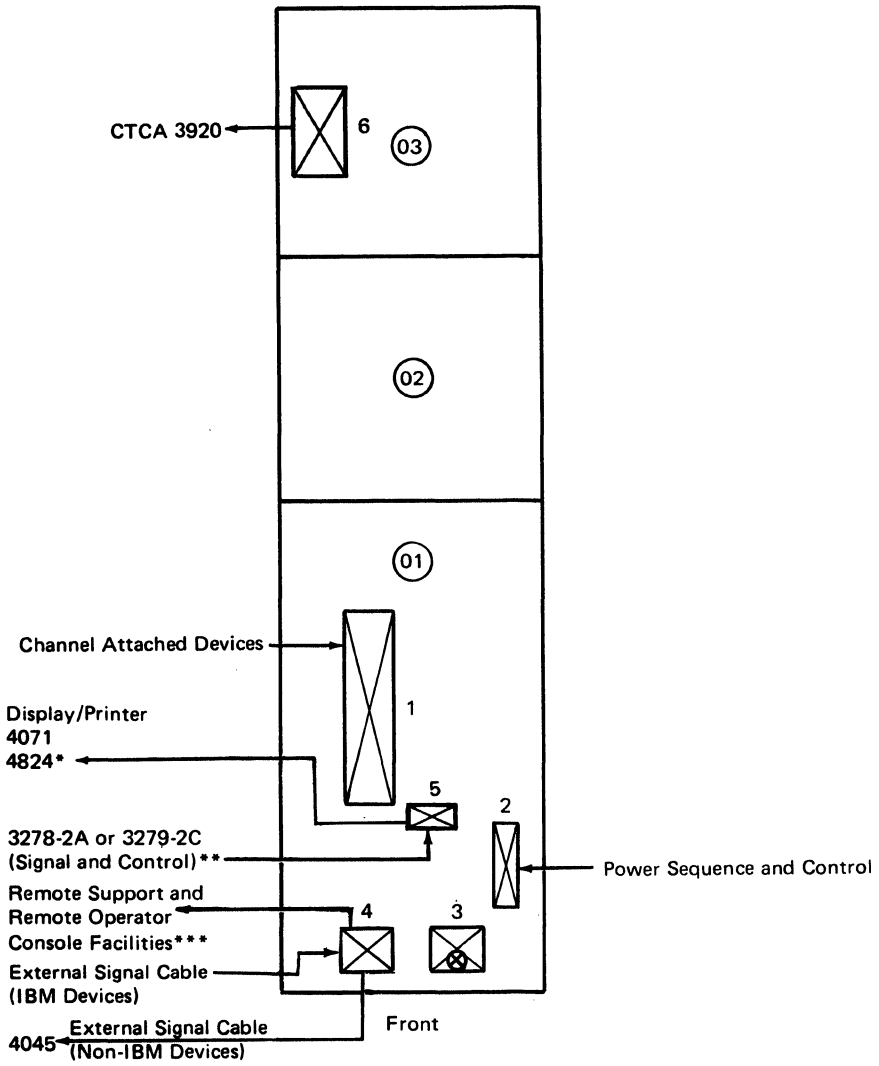
Operating Environment:

Temperature: 10-32°C (50-90°F)
Relative Humidity: 8-80%
Maximum Wet Bulb: 23°C (73°F)

Nonoperating Environment:

Temperature: 10-43°C (50-110°F)
Relative Humidity: 8-80%
Maximum Wet Bulb: 27°C (80°F)

IBM 4341 Processor Cabling Schematic



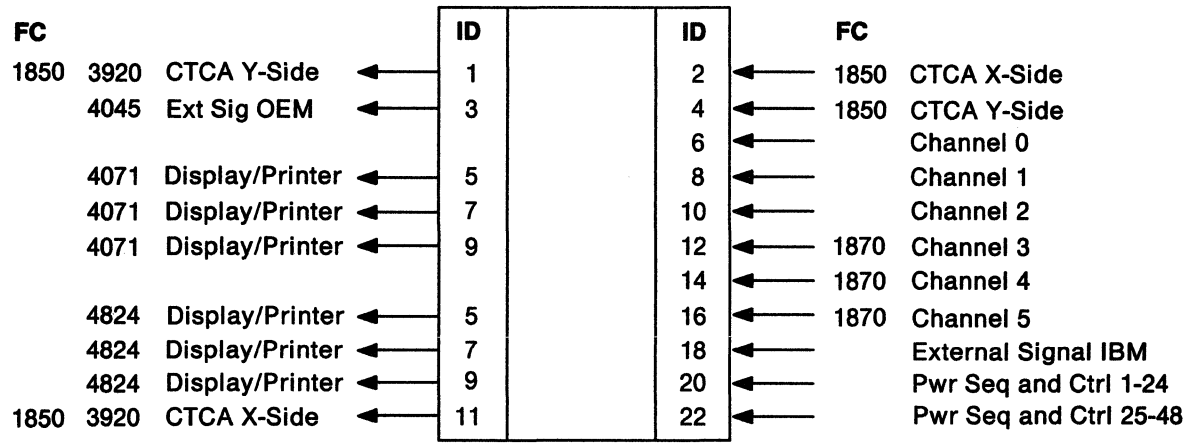
Display Console(s)/Printer(s) Attachment(s)

* Any combination of three units maximum: 3278-2A or 3279-2C Display Consoles and/or 3268-2 or 3287 Printers.

** One 3278-2A or 3279-2C Display Console with operator control panel. Control panel cable and signal cable shipped with processor; fixed length: 7.6 m (25 ft). Recommended minimum distance between console and processor: 1 m (3.3 ft). (See "Electromagnetic Compatibility" on page 1-9.)

*** A 10-m (33-ft), fixed length, interface cable [7.6 m (25 ft) usable length] is shipped with the processor. For feature 9510 (2830 in Canada), an adapter cable (to facilitate coupler connection where the common carrier does not provide a 4-prong jack) is also shipped with the the processor. See Appendix D.

IBM 4341 Processor Cabling Charts



From the 4341 Processor:

FC	Group Number	Cables in Group	Conn ID	Max Length		Frame/Exit	Comments	Notes
				M	(Ft)			
1850	3920	2	11	61	(200)	03 06	CTCA X-Side	1
1850	3920	2	1	61	(200)	03 06	CTCA Y-Side	1
	4045	1	3	30.5	(100)	01 04	EXT SIG OEM	
	4824	1	5	30.5	(100)	01 05	Display/Printer	2, 3
	4824	1	7	30.5	(100)	01 05	Display/Printer	2, 3
	4824	1	9	30.5	(100)	01 05	Display/Printer	2, 3
	4071	1	5	30.5	(100)	01 05	Display/Printer	
	4071	1	7	30.5	(100)	01 05	Display/Printer	
	4071	1	9	30.5	(100)	01 05	Display/Printer	

To the 4341 Processor:

FC	Conn ID	Frame/Entry		Comments	Notes
1850	2	03	06	CTCA X-Side	
1850	4	03	06	CTCA Y-Side	
	6	01	01	Channel 0	
	8	01	01	Channel 1	
	10	01	01	Channel 2	
1870	12	01	01	Channel 3	4
1870	14	01	01	Channel 4	4
1870	16	01	01	Channel 5	4
	18	01	04	Ext Sig IBM	
	20	01	02	Pwr Seq & Ctrl 1-24	
	22	01	02	Pwr Seq & Ctrl 25-48	

Notes:

1. Maximum cumulative cable length available to attach up to seven control units is 61 m (200 ft.), unless modified by general control unit-to-channel cabling schematic. This restriction applies to both connected channels. See Appendix A.
2. Cable group 4824 provides up to 30.5 m (100 ft) of coaxial signal cable with a BNC connector on each end and must be ordered separately (one per I/O unit). Additional cable, up to a maximum total cable length of 1 500 m (4,921 ft), must be provided by the customer. For cable specifications and ordering information, refer to the specification pages of the appropriate **Installation Manual – Physical Planning** for the peripheral device being installed. For cable installation information, refer to **Installation and Assembly of Coaxial Cable and Accessories for attachment to IBM Products**, Order No. GA27-2805.
3. If local code requires Teflon[1] insulated coaxial cable, order cable group 4071 instead of cable group 4824.
4. Channel 3, 4, and 5 are standard on Model Groups 2, 11, and 12; optional on Model Groups 1, 9, and 10 (FC 1870).

[1] Trademark of E.I. duPont de Nemours & Co., Inc.

IBM 4381 Processor

Plan View (Metric Scale: 20 mm = 1 m)

English measurements are shown in parentheses.

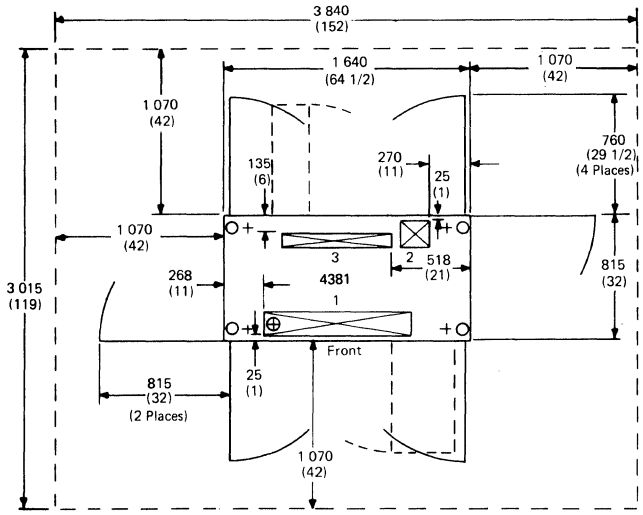
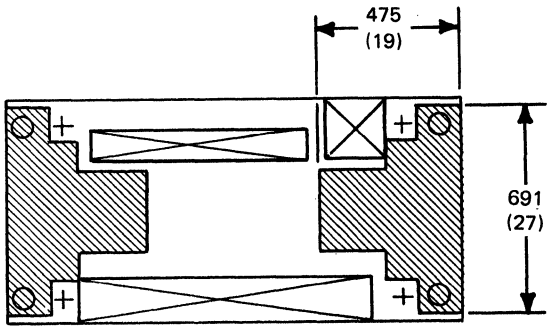
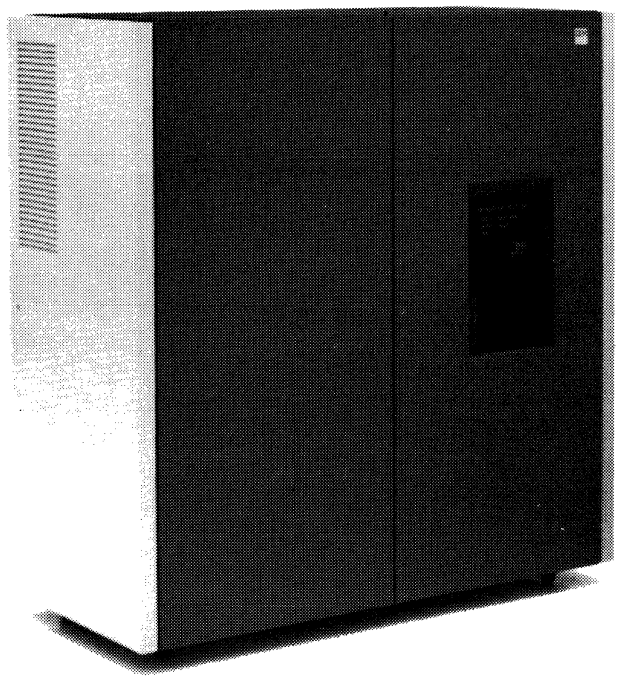


Plate assemblies shipped for Model Groups 1 and 2 with CTCA (FC1850) and for all Model Group 3 machines are not required for any model group shipped after December 1985. Cable floor cutouts cannot be located beneath plate assemblies, when applicable. (shaded area).



(Do Not Scale)



Cable Entry/ Exit Number	Dimensions (See Note 3)	
	Millimeters	Inches
1	160 x 984	6 x 39
2	176 x 188	7 x 7-1/2
3	80 x 735	3 x 29

Notes:

1. A console table is available from IBM as an optional feature.
2. Entry/exit holes are measured from edge of frame, not the covers.
3. Cable entry/exit holes shown represent locations on the machine and do not necessarily represent or require a corresponding hole in the floor. Cables from more than one entry/exit hole may be consolidated in a given hole in the floor. If this is done, allow for the additional cable length that may be required. (See 2-14.)
4. Because the machine does not have skirts, cable exit points in nonraised-floor installations are restricted only by the location of the casters.

IBM 4381 Processor Model Groups 1, 2, 11, 12, 13, 21, 22, 23, and 91E Uniprocessor Specifications

Dimensions:

With Covers:

	Front	*Side*	*Height*
mm	1 640	815	1 790
(inches)	(64-1/2)	(32)	(70-1/2)

Covers Removed:

	Front	*Side*	*Height*
mm	1 525	750	1 775
(inches)	(60)	(29-1/2)	(70)

Service Clearances:

	Front	Rear	Right	Left
mm	1 070	1 070	1 070	1 070
(inches)	(42)	(42)	(42)	(42)

Weight: 700 kg (1,550 lb)*

For WT 50 Hz (and 60 Hz for Japan):
770 kg (1,700 lb)*

* Includes 18 kg (40 lb) of packing material.

Heat Output (maximum):

4 000 Watts (13,650 BTU/hr)

Airflow:

37 m^3/min (1,300 cfm)

Power Requirements (50 and 60 Hz):

kVA 4.7
Phase 3

Voltages:

	Nominal	*Minimum*	*Maximum*
50 Hz	200	180	220
	220	193	238
	380	333	410
	400	350	432
	415	363	448
60 Hz	200	180	220
	208	180	220
	220	193	238
	240	208	254

Power Cord:

meters 4.3 [optional, 1.8]
(feet) (14) [optional, 6]

Power Cord Style: E1 (See Appendix B.)

U.S.A. and Canada: (See Appendix F)

Plug R&S, 7328 (IBM Provided)
Receptacle R&S, 7324 (Customer Provided)
Connector R&S, 7428 (Customer Provided)

Note: If a 43XX processor is being replaced by a 4381 processor, a larger power requirement (receptacle/connector, service protection) is required.

Noise Emission Levels

For definitions see "Acoustics (Noise-Emission Levels)" on page 1-9.

	LwAd		**< LpA > m**	
Hz	**Operating (bels)**	**Idling (bels)**	**Operating (db)**	**Idling (db)**
60	8.0	8.0	53.5	53.5
50	7.5	7.5	53.0	53.0

Operating Environment:

Temperature: 10-32°C (50-90°F)
Relative Humidity: 8-80%
Maximum Wet Bulb: 23°C (73°F)

Nonoperating Environment:

Temperature: 10-43°C (50-110°F)
Relative Humidity: 8-80%
Maximum Wet Bulb: 27°C (80°F)

Note: If the 4381 processor has to be tipped on its side or lifted, order upending RPQ number S00582.

IBM 4381 Processor Model Groups 3, 14, 24, and 92E Dual Processor Specifications

Dimensions:

With Covers:

	Front	*Side*	*Height*
mm	1 640	815	1 790
(inches)	(64-1/2)	(32)	(70-1/2)

Covers Removed:

	Front	*Side*	*Height*
mm	1 525	750	1 775
(inches)	(60)	(29-1/2)	(70)

Service Clearances:

	Front	Rear	Right	Left
mm	1 070	1 070	1 070	1 070
(inches)	(42)	(42)	(42)	(42)

Weight: 843 kg (1,855 lb)*

For WT 50 Hz (and 60 Hz for Japan):
910 kg (2,005 lb)*

* Includes 18 kg (40 lb) of packing material.

Heat Output (maximum):

6 600 Watts (22,500 BTU/hr)

Airflow:

57 m^3/min (2,013 cfm)

Power Requirements (50 and 60 Hz):

kVA 7.2
Phase 3

Voltages:

	Nominal	*Minimum*	*Maximum*
50 Hz	200	180	220
	220	193	238
	380	333	410
	400	350	432
	415	363	448
60 Hz	200	180	220
	208	180	220
	220	193	238
	240	208	254

Power Cord:

meters	4.3 [optional, 1.8]
(feet)	(14) [optional, 6]

Power Cord Style: E1 (See Appendix B.)

U.S.A. and Canada: (See Appendix F)

Plug	R&S, 7328 (IBM Provided)
Receptacle	R&S, 7324 (Customer Provided)
Connector	R&S, 7428 (Customer Provided)

Note: If a 43XX processor is being replaced by a 4381 processor, a larger power requirement (receptacle/connector, service protection) is required.

Noise Emission Levels

For definitions see "Acoustics (Noise-Emission Levels)" on page 1-9.

	LwAd		**< LpA > m**	
Hz	**Operating (bels)**	**Idling (bels)**	**Operating (db)**	**Idling (db)**
60	8.2	8.2	55.0	55.0

Operating Environment:

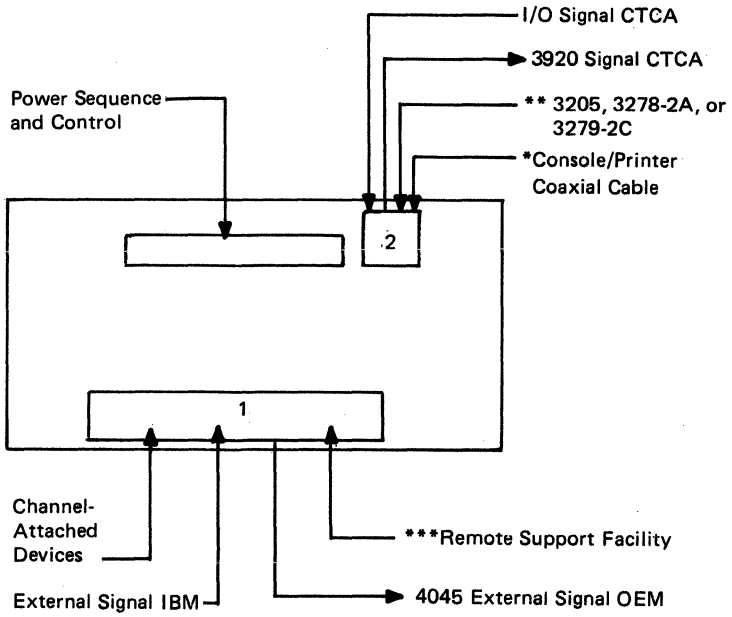
Temperature: 10-32°C (50-90°F)
Relative Humidity: 8-80%
Maximum Wet Bulb: 23°C (73°F)

Nonoperating Environment:

Temperature: 10-43°C (50-110°F)
Relative Humidity: 8-80%
Maximum Wet Bulb: 27°C (80°F)

Note: If the 4381 processor has to be tipped on its side or lifted, order upending RPQ number S00582.

IBM 4381 Processor Cabling Schematic



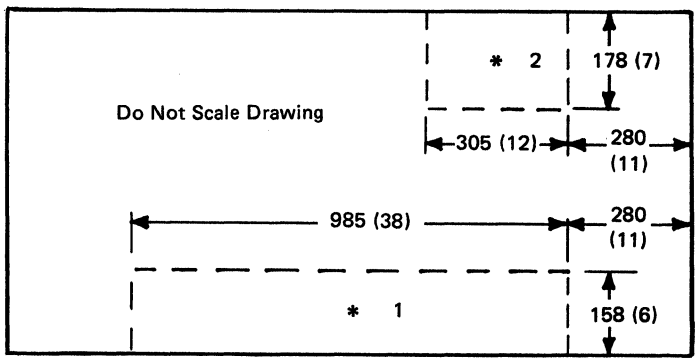
Display Console(s)/Printer(s) Attachment(s)

* Any combination of three units maximum: 3205, 3278-2A, 3279-2C Display Consoles and/or 3268-2 or 3287 Printers. The 3205 cannot be intermixed with the other display consoles (3278-2A or 3279-2C).

The optional units are attached at the customer access panel (see Figure 2-3 on page 2-15). Customer provides coaxial cable. For cable information, refer to *Installation and Assembly of Coaxial Cable and Accessories for Attachment to IBM products*, GA27-2805.

** One 3205, 3278-2A, or 3279-2C Display Console with Operator Control Panel. Control panel cable (see Figure 2-2 on page 2-15) and signal cable are shipped with the processor; fixed length: 7.6 m (25 ft). Recommended minimum distance between console and processor: 1 m (3.3 ft). (See "Electromagnetic Compatibility" on page 1-9.) The stand-alone operator control panel, used with the 3205 (see Figure 2-1 on page 2-15), is shipped with the processor.

*** A 10-m (33 ft) fixed length, interface cable [7.6 m (25 ft) usable length] is shipped with the processor. For feature 9510, an adapter cable (to facilitate coupler connection where the common carrier does not provide a 4-prong jack) is also shipped with the processor. See Appendix D.



Recommended Floor Cutouts

Note: Recommended cable entry/exit floor cutouts for maximum configuration. Cable hole locating dimensions are measured from outside edge of frame, not the cover.

IBM 4381 Operator Control Panel (OCP) and Customer Access Panel

The OCP shipped with the 4381 processor is intended for use with an IBM 3205 Color Console. If the console is to be a 3278-2A or 3279-2C with an OCP keyboard, the OCP cable must be removed from the 4381 OCP and connected to the keyboard OCP in order to avoid a potential safety hazard of having inactive Power ON/OFF keys accessible to the operator.

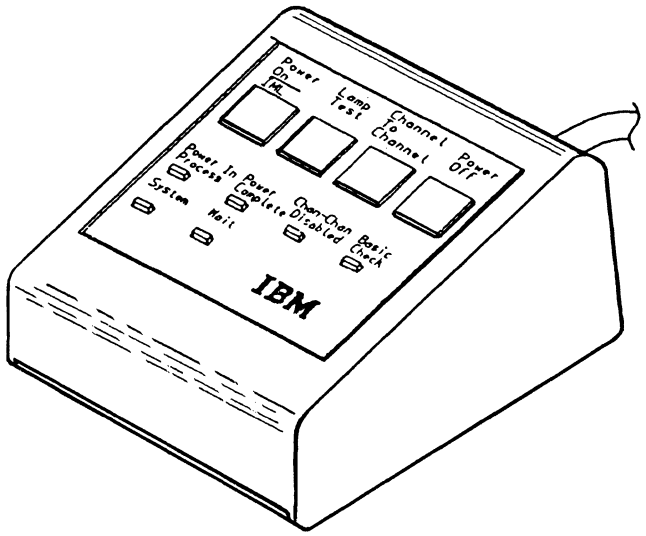


Figure 2-1. 3205 Operator Control Panel

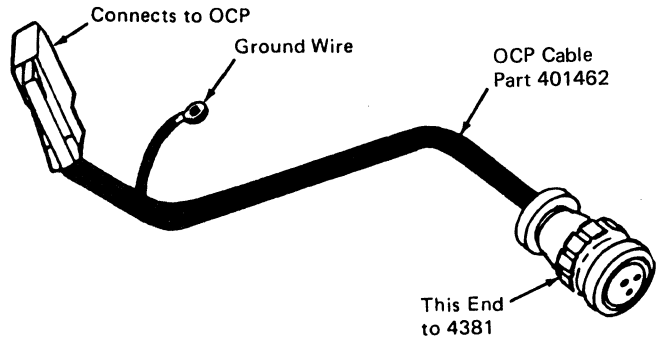


Figure 2-2. OCP Cable

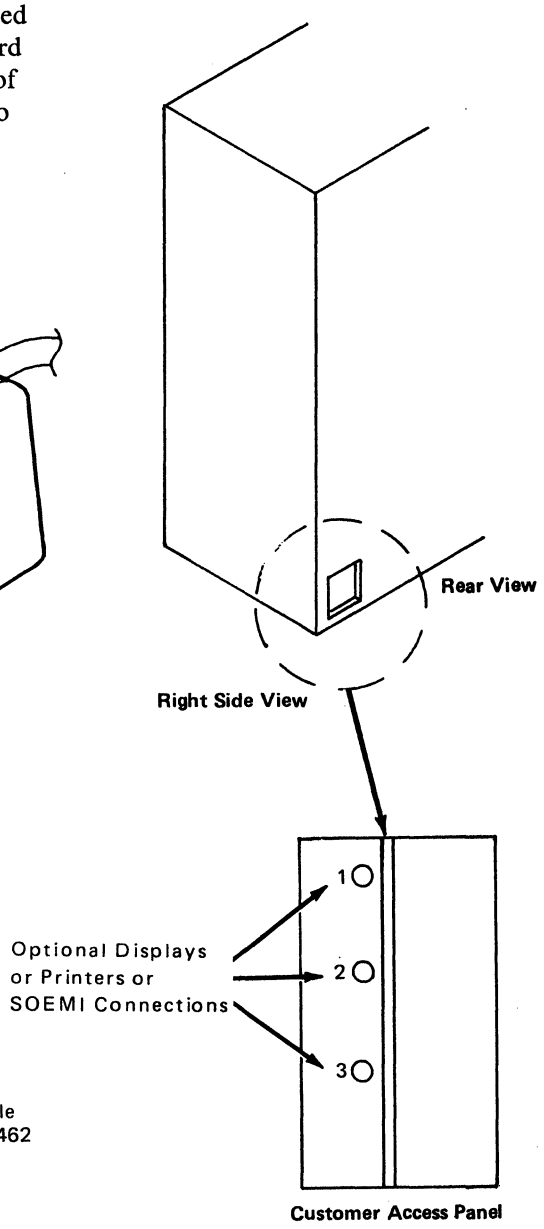
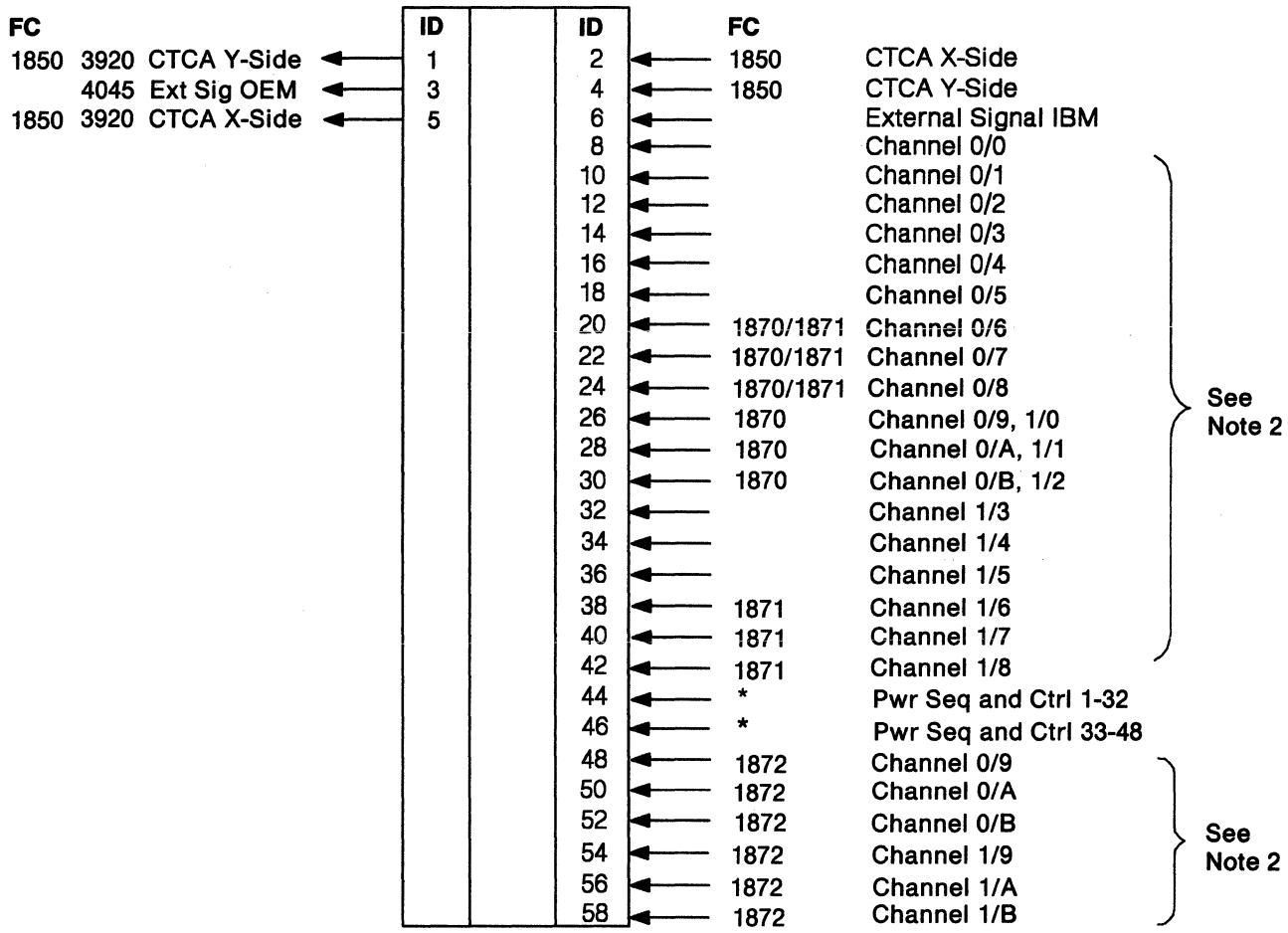


Figure 2-3. Customer Access Panel For Optional Consoles/Printers

IBM 4381 Processor Cabling Charts



* Power sequence and control is a standard feature on the 4381 Processor. It enables I/O control units to power on/off sequentially when the processor powers on/off. The maximum number of I/O devices that can be powered on/off on the 4381 Uniprocessor Model Groups 1, 2, 11, 12, 13, 21, 22, 23, and 91E is thirty-two (32). The maximum number for the 4381 Dual Processor Model Groups 3, 14, 24, and 92E is forty-eight (48). For more information on power sequencing, refer to *Sys/360, Sys/370 Power Control Interface OEMI*, GA22-6906.

From the 4381 Processor:

FC	Group Number	Cables in Group	Conn ID	Max Length		Exit	Comments	Notes
				M	(Ft)			
1850	3920	2	1	61	(200)	02	CTCA Y-Side	1
	4045	1	3	61	(200)	01	Ext Sig OEM	
1850	3920	2	5	61	(200)	02	CTCA X-Side	1

To the 4381 Processor:

FC	Conn ID	Entry	Comments	Notes
1850	2	02	CTCA X-Side	1
1850	4	02	CTCA Y-Side	1
	6	01	Ext Sig IBM	
	8	01	Channel 0/0	2,3,4
	10	01	Channel 0/1	2,3,4
	12	01	Channel 0/2	2,3,4
	14	01	Channel 0/3	2,3,4
	16	01	Channel 0/4	2,3,4
	18	01	Channel 0/5	2,3,4
1870/1871	20	01	Channel 0/6	2,3,5
1870/1871	22	01	Channel 0/7	2,3,5
1870/1871	24	01	Channel 0/8	2,3,5
1870	26	01	Channel 0/9, 1/0	2,3,4
1870	28	01	Channel 0/A, 1/1	2,3,4
1870	30	01	Channel 0/B, 1/2	2,3,4
	32	01	Channel 1/3	2,4
	34	01	Channel 1/4	2,4
	36	01	Channel 1/5	2,4
1871	38	01	Channel 1/6	2,5
1871	40	01	Channel 1/7	2,5
1871	42	01	Channel 1/8	2,5
	44	03	Pwr Seq & Ctrl 1-32	6
	46	03	Pwr Seq & Ctrl 33-48	7
1872	48	01	Channel 0/9	2,8
1872	50	01	Channel 0/A	2,8
1872	52	01	Channel 0/B	2,8
1872	54	01	Channel 1/9	2,8
1872	56	01	Channel 1/A	2,8
1872	58	01	Channel 1/B	2,8

Notes:

1. Maximum cumulative cable length to attach up to five control units is 61 m (200 ft), unless modified by general control-unit-to-channel cabling schematic. This restriction applies to both connected channels. See Appendix A.
2. For Dual Processor Model Groups 3, 14, 24, and 92E, channel entries are listed by processor number and channel number. Example: Processor 0, Channel 0 is denoted as 0/0.
3. For Uniprocessor Model Groups 1, 2, 11, 12, 13, 21, 22, 23, and 91E, channels denoted 0/0 through 0/5 are standard; channels denoted 0/6 through 0/B are optional (Feature Code 1870).
4. Standard on Dual Processor Model Groups 3, 14, 24, and 92E [(0/0 - 0/5 Processor 0) (1/0 - 1/5 Processor 1)].
5. Optional on Dual Processor Model Groups 3, 14, 24, and 92E [(0/6 - 0/8 Processor 0) (1/6 - 1/8 Processor 1)] (Feature Code 1871).
6. Standard on all Model Groups.
7. Standard on Dual Processor Model Groups 3, 14, 24, and 92E; not available on Uniprocessor Model Groups 1, 2, 11, 12, 13, 21, 22, 23, and 91E.
8. Optional on Dual Processor Model Groups 24 and 92E only. Feature Code 1872 (1871 is a prerequisite) for Model Groups 24 and 92E identifies six channels, 0/9, 0/A and 0/B for Processor 0, and 1/9, 1/A and 1/B for Processor 1. This feature is not available on any other Model Group (Feature Code 1872).

IBM recommends the use of reduced diameter channel cables (Group Number 0185) whenever possible on a 4381 Model Group 24 or 92E processor.

Appendix A. General Cabling Information

Control-to-Channel Cabling

Generally, the maximum cable length to attach to a channel is 122 meters (400 feet). Exceptions to this are noted on the cabling schematics for the individual control units.

All control units are serially connected to the channels.

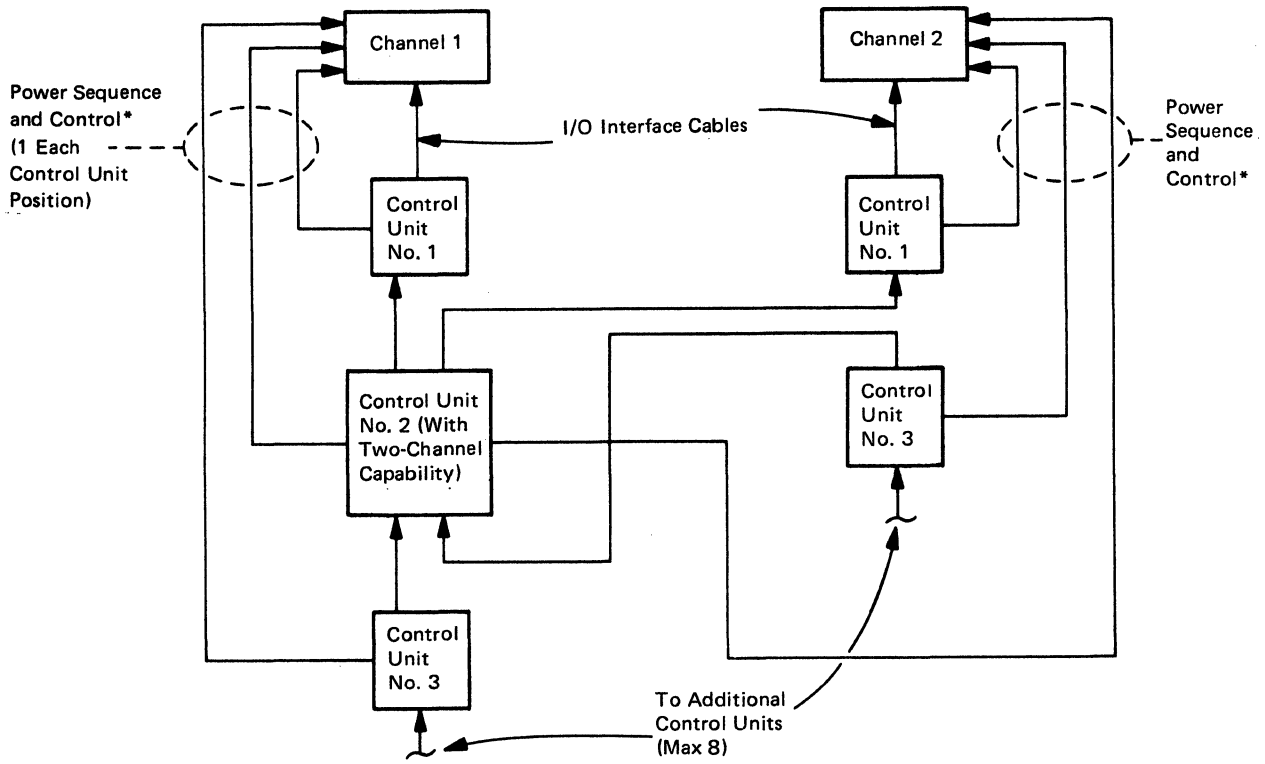

Channel 1
Channel 2
Power Sequence and Control* (1 Each Control Unit Position)
I/O Interface Cables
Power Sequence and Control*
Control Unit No. 1
Control Unit No. 1
Control Unit No. 2 (With Two-Channel Capability)
Control Unit No. 3
Control Unit No. 3
To Additional Control Units (Max 8)

Figure A-1. Control-to-Channel Cabling

* Power sequencing is an option on most IBM equipment. Power sequence and control cables need not be ordered unless the customer desires to power the equipment on or off from a single location or the individual machine requires it for other reasons. See specification pages for specific requirements.

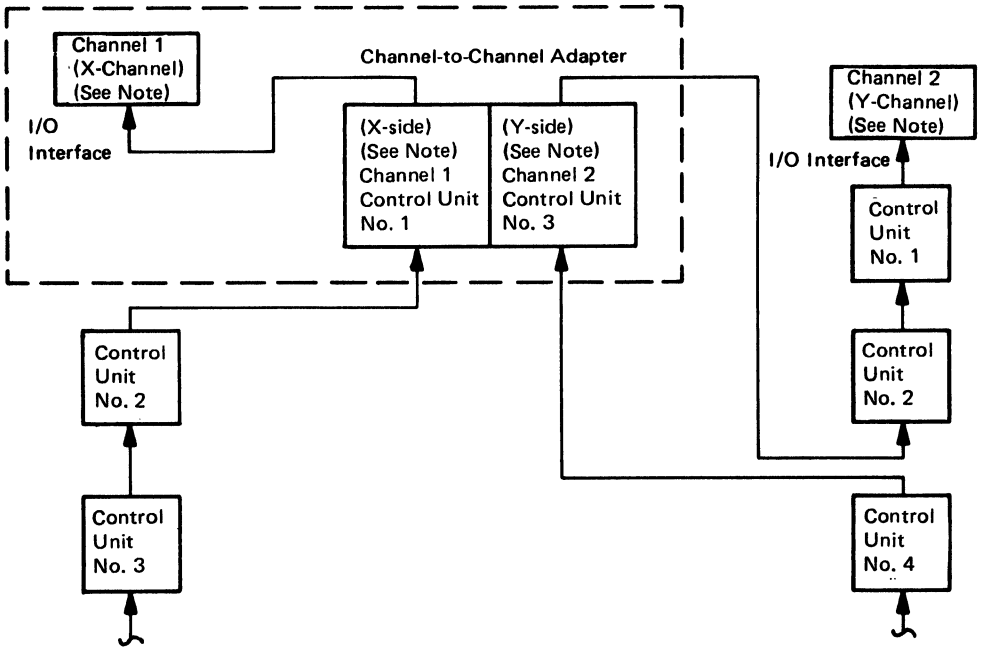
Channel-to-Channel Adapter Cabling

The 4341 channel-to-channel adapter (CTCA), feature 1850, uses one control unit position for each channel affected. The 4381 CTCA (feature 1850) uses three control unit positions for each channel affected. The adapter requires external cables to both the host (X) and guest (Y) channels.

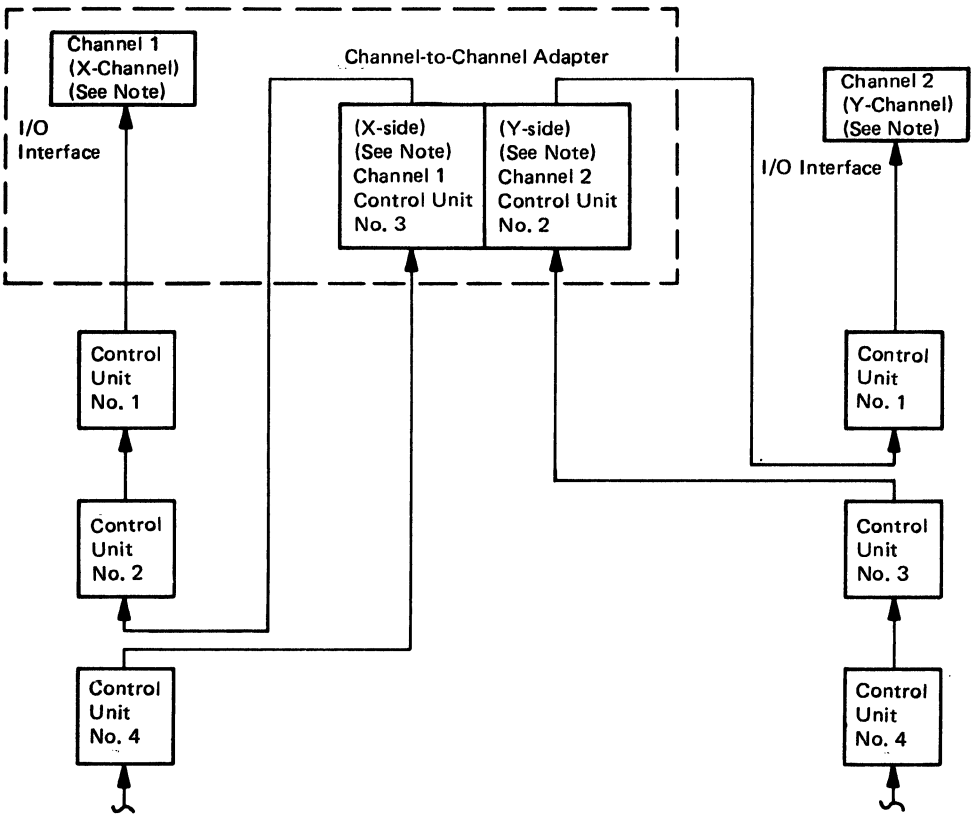
To install the channel-to-channel adapter:

1. Assign the adapter any control unit position or priority on the host or guest channel. Cable shipped with the feature is for wrap test.
2. Specify the host (X) and guest (Y) cabling as required.

Channel-to-Channel Adapter in First Control Unit Position



Channel-to-Channel Adapter in Any Control Unit Position



Note: X refers to host channel; Y refers to guest channel.

Appendix B. Power Cord Style Specifications and Plug Installation (World Trade)

Cable Specifications

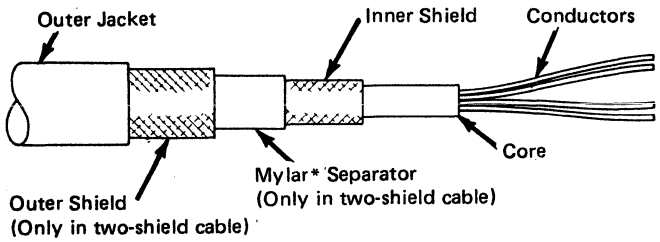
Power Cord Style	*Cable Nominal OD inches (mm)*	*Number of Shields*	*Conductors*		
			Quantity	*Nominal OD* inches (mm)*	*AWG No.*
A1	0.520 (13.2)	1	3	0.064 (1.6)	14
A2	0.510 (13.0)	1	3	0.081 (2.1)	12
A3	0.570 (14.5)	1	3	0.102 (2.6)	10
A4	0.375 (9.5)	1	3	0.051 (1.3)	16
A5	0.390 (9.9)	0	3	0.051 (1.3)	16
A6	0.560 (14.2)	0	3	0.064 (1.6)	14
A8	0.390 (9.9)	0	3	0.064 (1.6)	14
A9	0.374 (9.5)	0	3	0.040 (1.0)	18
B1	0.713 (18.1)	0	5	0.102 (2.6)	10
B2	0.693 (17.6)	1	5	0.064 (1.6)	14
D1	0.792 (20.1)	2	5	0.102 (2.6)	10
D2	0.750 (19.0)	1	5	0.102 (2.6)	10
D3	0.642 (16.3)	2	5	0.064 (1.6)	14
D4	0.914 (23.2)	2	4	0.102 (2.6)	10
E1	1.024 (26.0)	1	5	0.129 (3.3)	8
E2	1.400 (35.6)	0	5	0.232 (5.9)	4
E3	1.200 (30.5)	2	5	0.184 (4.7)	6
E4	1.200 (30.5)	0	5	0.184 (4.7)	6
E5	1.200 (30.5)	1	5	0.184 (4.7)	6
E6	1.240 (31.5)	2	4	0.184 (4.7)	6
E7	1.440 (36.6)	1	5	0.232 (5.9)	4
E8	0.974 (24.7)	0	5	0.129 (3.3)	8
E9	0.949 (24.1)	1	4	0.184 (4.7)	6
E10	1.340 (34.0)	1	4	0.232 (5.9)	4
F1	1.400 (35.6)	0	5	0.292 (7.4)	2
F2	1.646 (41.8)	1	5	0.292 (7.4)	2
F3	1.646 (41.8)	0	5	0.292 (7.4)	2
F4	1.293 (32.8)	1	4	0.292 (7.4)	2
G1			3	0.040 (1.0)	18
G2					
G3	0.360 (9.1)	0	–	0.051 (1.3)	16
G4	0.365 (9.3)	1	–	0.040 (1.0)	18

* This refers to solid, bare wire.

How to Install a Power Plug on Shielded Cable

To make power cable shielding effective, the shield (or shields) must be properly terminated at the plug end of the cable. Because various plugs are used in different countries, slight changes to the following instructions may be needed.

Bulk Cable Components

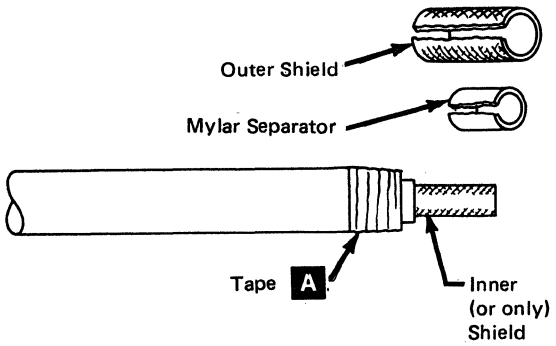


* Trademark of E.I. du Pont de Nemours & Co., Inc.

Preparing Bulk Cable End for Plug

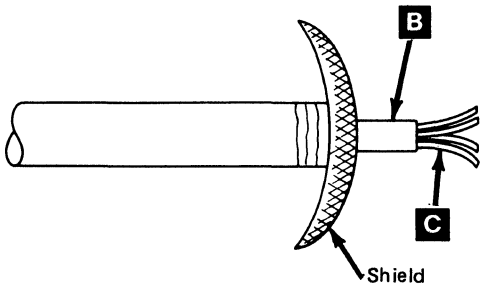
Use your discretion to ensure proper assembly of the cable and plug. Dimensions given are for reference only.

1. Remove outer jacket for 38 millimeters (1-1/2 inches) from end for 15- to 30-ampere cables or 70 millimeters (2-3/4 inches) from end for 45- to 60-ampere cables. If this is a one-shield cable, go to step 4.
2. (For two-shield cables only.) Remove the outer shield as far back as the outer jacket. The mylar separator is exposed. Wrap one full turn of electrical tape over the separator and another full turn of tape over the cut end of the outer shield; overlap onto the outer jacket. This tape is used to ensure complete electrical isolation between the inner and the outer shields. (See A.)



3. (For two-shield cables only.) Remove mylar separator for 25 millimeters (1 inch) from end for 15- to 30-ampere cables or 57 millimeters (2-1/4 inches) from end for 45- to 60-ampere cables. Do not cut the inner shield.
4. Do not cut the inner (or only) shield. Unbraid and carefully comb out the shield for 25 millimeters (1 inch) from end for 15- to 30-ampere cables or 57 millimeters (2-1/4 inches) from end for 45- to 60-ampere cables. The core is exposed. (See B.)

5. Remove core for a minimum of 19 millimeters (3/4 inch) from end. (See C .)

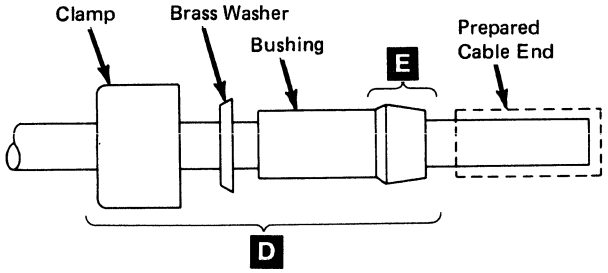


6. Carefully lay back the shield over the cable outer jacket. Wrap tape around the shield for temporary protection. Note that on two-shield cables, the outer shield must be insulated from the plug cap, equipment grounding (earth) wire, conduit, and so on. The outer shield is grounded at the machine end only. The inner (or only) shield should be grounded through the shell of the plug to the branch circuit conduit. Grounding the shield to the plug 360° is desirable; that is, making contact between the shield and the shell all the way around.

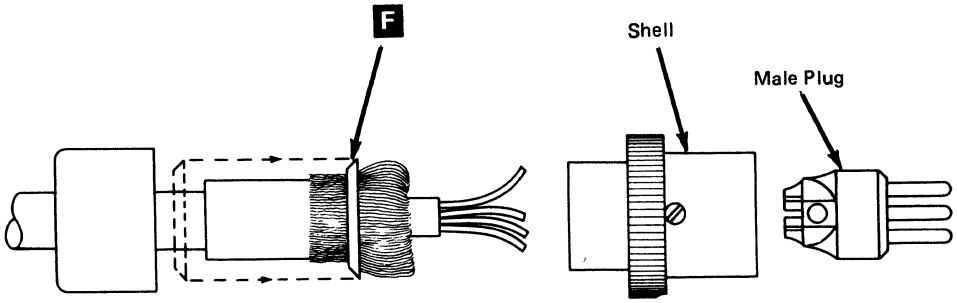
Installing the Plug

These next steps show the attachment of one type of plug. Modification will be needed to allow for various plugs used in different countries.

1. Install the clamp, brass washer, and bushing over the prepared cable end as shown at **D**.
2. Remove the protective tape from the shield and flair the shield strands.



3. Slide the bushing over against the shield.
4. Carefully lay the shield back over **E** of the bushing. Be sure to spread the strands of the shield evenly over the bushing surface.
5. Slide the brass washer over the shield and up against the mating surface of the bushing at **F**.
6. Wrap tape around the shield for one full turn and trim off the exposed strands of the shields.
7. Install the clamp and ensure that the mating surface is tightly against the brass washer.
8. Install the proper terminals and assemble the rest of the plug.



Appendix C. Template List

Unit	Order Number
4341	GX24-3729 (Metric Units) GX24-3666 (English Units)
4381	GX24-3951 (Metric Units) GX24-3952 (English Units)

For the order number of *channel-attached I/O* equipment templates, refer to:

- *IBM Input/Output Equipment Installation Manual – Physical Planning for System/360, System/370, and 4300 Processors,* GC22-7064, or
- *IBM Input/Output Equipment Reference Installation Manual – Physical planning: System/360, System/370, and 4300 Processors,* GC22-7069.

For planning the layout for the service area, use *IBM Physical Planning Template: Field Engineering Furniture and Test Equipment,* GX22-6925.

Appendix D. Communication Lines

Remote Support Facility and Remote Operator Console Facility

4341/4381 Feature 9510, RSF

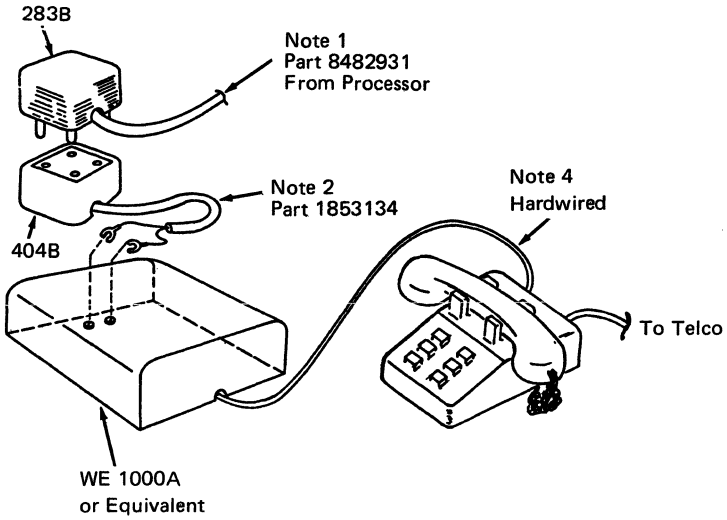
Integrated Modem and Coupler (U.S.A. and Canada)

Feature 9510 requires an external data protective coupler. The coupler is a manual answer CDT-type available from multiple sources in the U.S.A. The modular jack required for the line connection is specified by the manufacturer for the specific device.

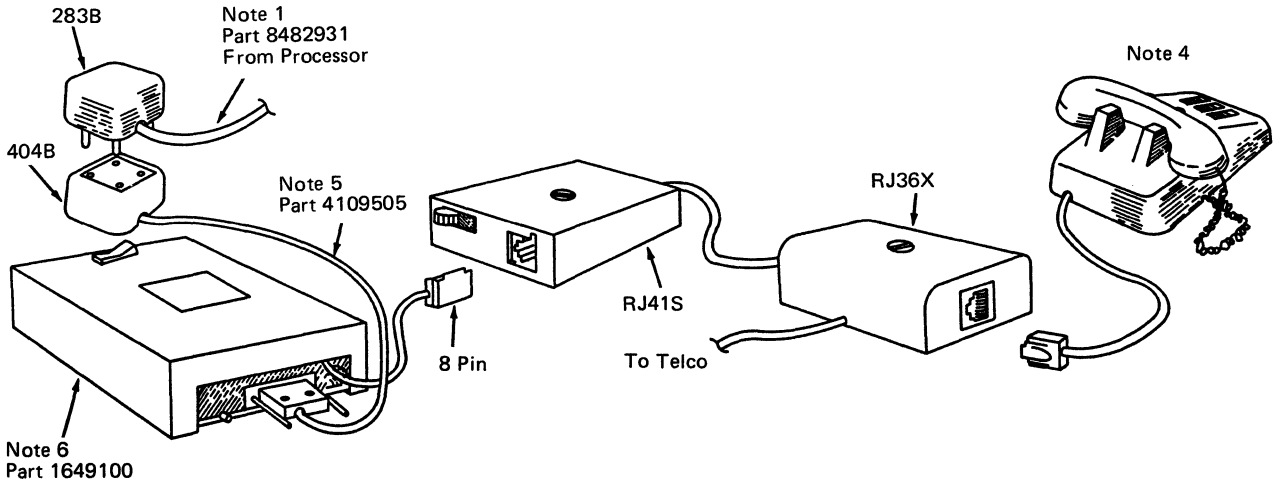
In Canada, the coupler is called a *Data Access Arrangement (DAA)*. This DAA is supplied with two screw terminals for connection on the business machine side. The 4300 RSF cable terminates in a four-prong plug. To provide a quick-disconnect capability between the business machine and the coupler, an adapter is shipped with the processor.

CDT-Type Protective Coupler	External Modem	Line Connection	Line Type
Western Electric 1000A (or equivalent)	Not Required	Common-Carrier provided before July 1, 1979	Switched Network Line for data up to 1200 BPS
OEM Protective Coupler		Common-Carrier provided USOC as specified by OEM instructions	
IBM Protective Coupler Part 1649100 (See Note 6 on D-4.)		Common-Carrier provided USOC RJ141S in fixed loss loop position	

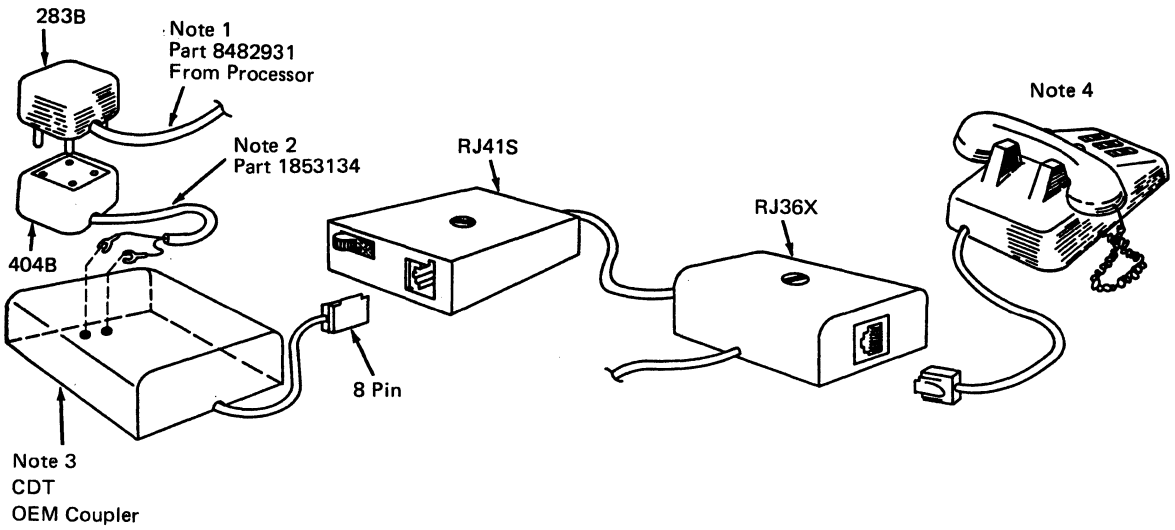
Feature 9510 – Western Electric Protective Coupler (or Equivalent)



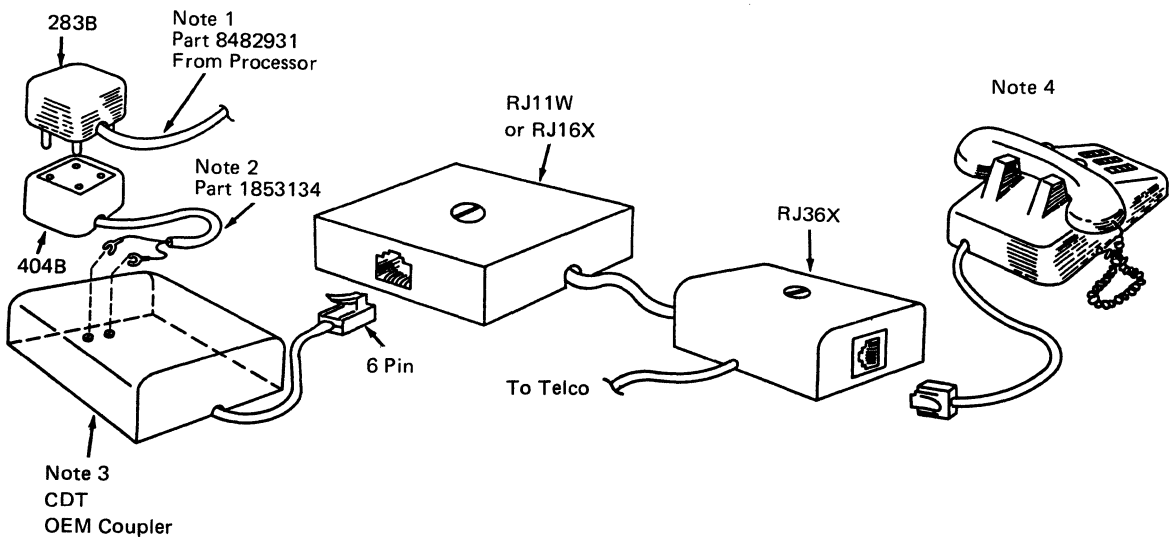
Feature 9510 – IBM Protective Coupler



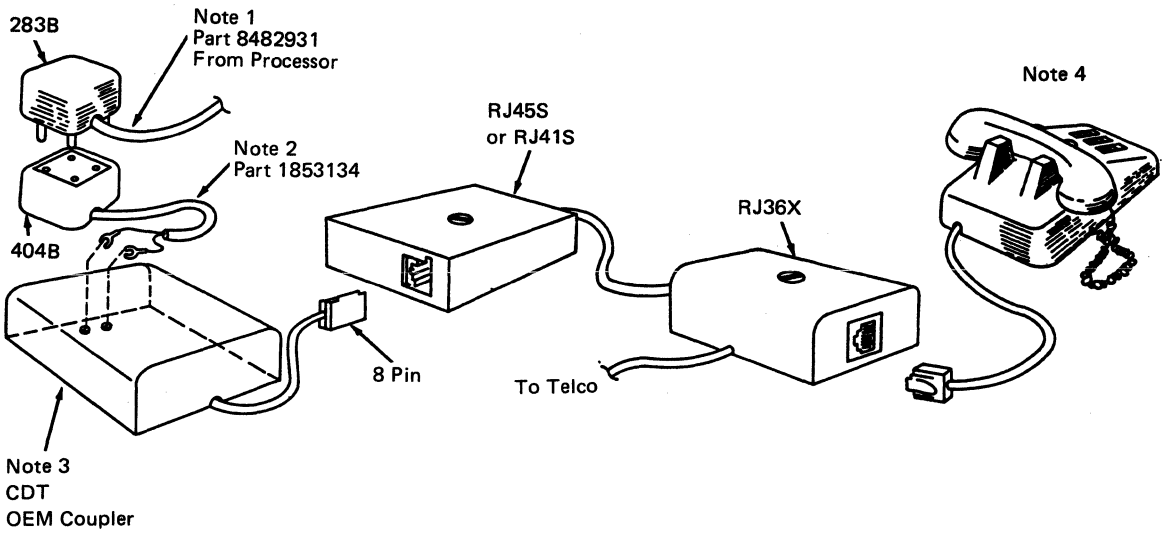
Feature 9510 – OEM Protective Coupler



Feature 9510 – Alternative Permissive OEM Protective Coupler



Feature 9510 – Alternative Programmable OEM Protective Coupler



Notes:

1. A 10-m (33-ft) fixed-length [7.6-m (25-ft) usable length] cable is shipped with the processor feature.
2. Adapter provided by IBM; shipped with processor.
3. Additional site planning and preparation may be required prior to installing the modem or coupler. See instructions for the device you intend to use. For FCC regulations, see OEM literature.
4. Customer-provided telephone handset with exclusion key (or equivalent) should be installed adjacent to display console for convenience.
5. Cable adapter is ordered separately from IBM (RPQ S00450 – Part 4109505).
6. For IBM Protective Coupler (Part 1649100), see *Protective Coupler Part 1649100 Installation and Planning Guide,* Order No. GA27-3315.

Customer-Ordering Information For Feature 9510

1. *Communication Facility Requirements:*
   - Line Type: Dial-Up Business Line
     (May be Touch-Tone[1] or Rotary Dial)
   - Line Speed: 1200 BPS
   - Line Termination: Determined by Customer-Supplied Protective Coupler
   - For Exclusion Key (USOC RTC-type) telephone attachment, use USOC RJ36X Jack
   - FCC Registration Information: Determined by Customer-Supplied Protective Coupler.
2. *Protective Coupler Requirements:*
   - CDT-Type (See Appendix D, "Communication Lines" on page D-1 for additional information.)
3. *Multiple-Function Telephone (USOC RTC type) Required Options:*
   (Available from telephone vendor)
   - A1 Manual Answer Mode (telephone set controls line)
   - B3 Aural Monitoring Not Provided
   - C5 Touch-Tone or C6 Rotary Dial (must be the same as line type).

[1] Trademark of American Telephone and Telegraph Co.

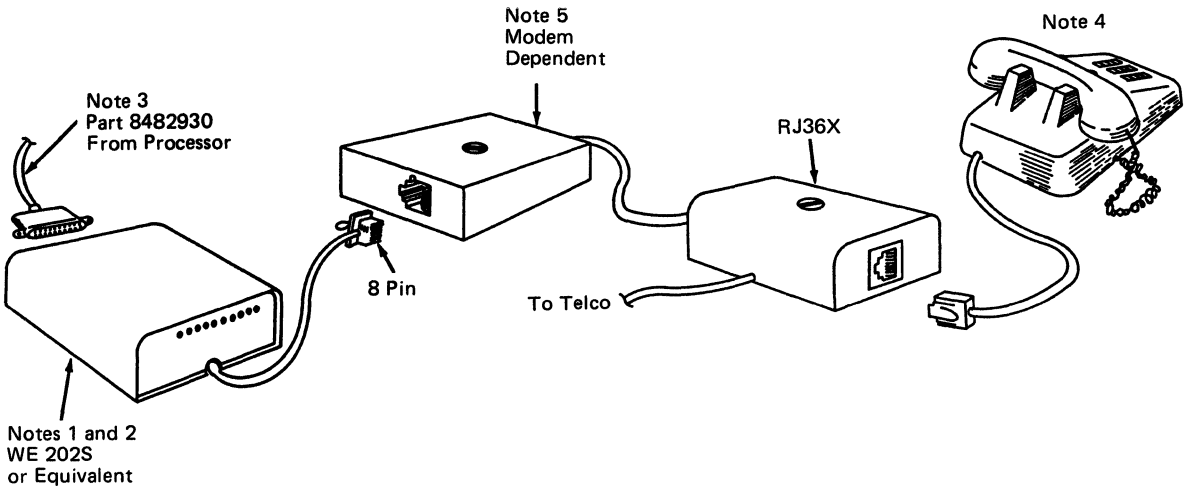
4341/4381 Feature 9511, RSF/ROCF

External Interface Adapter (U.S.A. and Canada)

Feature 9511 requires an external modem attachment through an EIA interface.

The required modem must be compatible with the WE202S modem interface and operation; if in the USA, the modem must also be registered with the FCC.

CDT-Type Protective Coupler	External Modem	Line Connection	Line Type
Modem dependent	Western Electric 202S or equivalent (See Notes 1 and 2)	Common-Carrier provided before January 1, 1983	Switched Network Line for data up to 1200 BPS
	OEM equivalent to WE202S interface and operation (See Notes 1 and 2)	Common-Carrier provided USOC as specified by OEM instructions	



Notes:

1. The following Western Electric 202S Modem (or equivalent) strapping options are required:

   * Local Copy Not Used
   * Receive Data Squelch – 156 ms
   * RS232C (Voltage) Interface
   * Soft Carrier Turnoff – 24 ms
   * Auto-Call Unit (ACU) Off
   * Clear to Send (CTS) Delay – 180 ms
   * Reverse Channel Not Used
   * Auto-Answer Off (On for ROCF)
   * Receive Data Clamp In
   * Carrier under Control of RTS
   * Business Machine Clocking
   * Grounding – AA Connected to BB

* Speed Greater than 900 BPS
* Fast Carrier Detect (CD) Out − 23 ms

2. Additional site planning and preparation may be required prior to installation of modem or coupler units. See instructions for the device you intend to use. For FCC regulations, see OEM literature.
3. A 10-m (33-ft) fixed-length [7.6-m (25-ft) usable length] cable is shipped with the processor feature.
4. Customer provided telephone handset with exclusion key (or equivalent) should be installed adjacent to display console for convenience.
5. Connection or data jack provided by common carrier as required by modem instructions.

Customer-Ordering Information For Feature 9511

1. *Communication Facility Requirements:*
   - Line Type: Dial-Up Business Line
     (May be Touch-Tone[2] or Rotary Dial)
   - Line Speed: 1200 BPS
   - Line Termination: Determined by Customer-Supplied Modem
   - For Exclusion Key (USOC RTC-type) telephone attachment, use USOC RJ36X Jack
   - FCC Registration Information: Determined by Customer-Supplied Modem
2. *Modem Requirements:*
   - WE202S or Equivalent 202-Type (see "4341/4381 Feature 9511, RSF/ROCF" on page D-6 for option details).
3. *Multiple-Function Telephone (USOC RTC type) Required Options:*
   (Available from telephone vendor)
   - A1 Manual Answer Mode (telephone set controls line)[3]
   - B3 Aural Monitoring Not Provided
   - D8 Voice Mode Indication (modem dependent)
   - C5 Touch-Tone or C6 Rotary Dial (must be the same as line type).

---

[2] Trademark of American Telephone and Telegraph Co.

[3] When ROCF Auto-Answer is used, the A2 option (data set controls line) is recommended instead of the A1 option. (Modem option Auto-Answer must be on.)

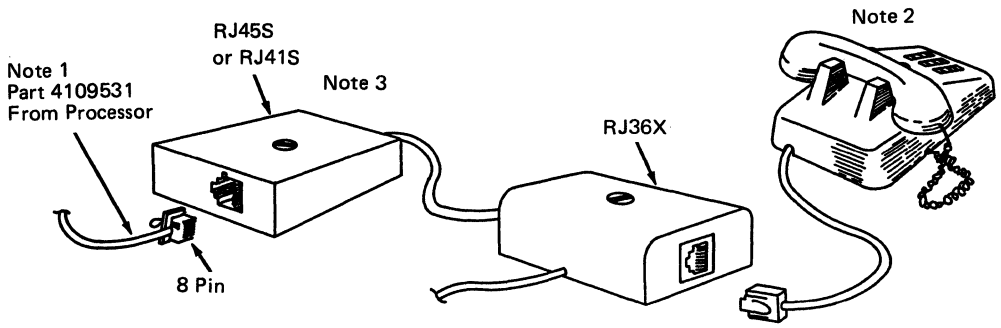
4341 Feature 9512 RSF

Integrated Modem and Coupler (U.S.A. only)

Feature 9512 provides an FCC registered coupler that can be attached directly to the public switched telephone network.

See Appendix E, "FCC Regulations Governing Integrated Protective Circuitry" on page E-1 for FCC regulations governing the protective coupler.

CDT-Type Protective Coupler	External Modem	Line Connection	Line Type
Not Required	Not Required	USOC RJ45S or USOC RJ41S (set for Programmable Mode Connection) and for Exclusion Key, Telephone Attachment USOC RJ36X.	Switched Network Line for Data up to 1200 BPS



Notes:

1. A 10-m (33-ft) fixed-length [7.6-m (25-ft) usable length] cable is shipped with the processor feature.
2. Customer provided telephone handset with exclusion key (or equivalent) should be installed adjacent to display console for convenience.
3. RJ45S (or RJ41S) is provided by the common carrier.

Customer-Ordering Information For Feature 9512

1. *Communication Facility Requirements:*

   - Line Type: Private Dial-Up Business Line
     (May be Touch-Tone[4] or Rotary Dial)
   - Line Speed: 1200 BPS
   - Use line termination jack USOC RJ45S or USOC RJ41S with switch set for programmable connection.
   - For Exclusion Key Telephone (USOC-type) attachment, use USOC RJ36X Jack.
   - FCC Registration Information:

     FCC Registration Number AN09SA-67992-DP-N

     Ringer Equivalence Number (REN): 0.8 B

2. *Exclusion Key Telephone (USOC RTC-type) Required Options:*
   (Available from telephone vendor)

   - A1 Manual Answer Mode (telephone set controls line)[5]
   - B3 Aural Monitoring Not Provided
   - D8 Voice Mode Indication (for feature 9514 only)
   - C5 Touch-Tone or C6 Rotary Dial (must be the same as line type).

---

[4] Trademark of American Telephone and Telegraph Co.

[5] For Feature 9514 when ROCF (Auto-Answer) is used, the A2 option (data set controls line) is recommended instead of the A1 option.

4381 Feature 9514 RSF/ROCF

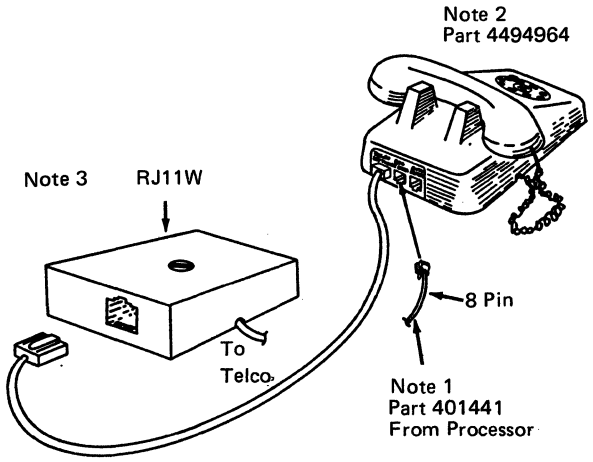
Integrated Modem and Coupler (U.S.A.)

Feature 9514 provides an FCC registered coupler and a special exclusion-key telephone that can be attached directly to the public switched telephone network. Feature 9514 provides dial-up capabilities for RSF and ROCF.

See Appendix E, "FCC Regulations Governing Integrated Protective Circuitry" on page E-1 for FCC regulations governing the protective coupler.

CDT-Type Protective Coupler	External Modem	Line Connection	Line Type
Not Required	Not Required	USOC RJ11W (USOC RJ16X or RJ36X may be used; see Note 3)	Switched Network Line for Data up to 1200 BPS

Note: This arrangement has a fixed transmit level of -9db, which may not be adequate at some installations. The customer may be required to supply the telephone facilities described under Feature 9512 if the transmit level (-9db) is inadequate.



Notes:

1. A 10-m (33-ft) fixed-length [7.6-m (25-ft) usable length] cable is shipped with the processor feature.
2. IBM-supplied special exclusion key telephone (Part 4494964) is prewired with required options. The customer is responsible for unpacking, assembling, and connecting the telephone.
3. Customer or common carrier provided RJ11W or RJ11C telephone jack (RJ16X or RJ36X may be used).

Customer-Ordering Information For Feature 9514

1. *Communication Facility Requirements:*

   - Line Type: Private Dial-Up Switched Network Line or PBX Network.

     Note: The IBM-supplied special exclusion key telephone (part 4494964) is a rotary dial telephone. If the PBX network does not support a rotary type telephone, the customer has the following options:

     - Have the local telephone company install a private switched line to the IBM supplied telephone.
     - Request the PBX supplier to support a rotary type telephone.
     - Customer provides his own phone.

   - Line Speed: 1200 BPS
   - Line Connection: Use USOC RJ11W or RJ11C
   - FCC Registration Information:
     - 4381

       FCC Registration Number AN09SA-67992-DP-N
       Ringer Equivalence Number (REN): 0.8 B

     - Special Exclusion Key Telephone

       FCC Registration Number and Ringer Equivalence Number (REN) are listed on label attached to base of telephone.

2. *IBM Special Exclusion Key Telephone Options:*

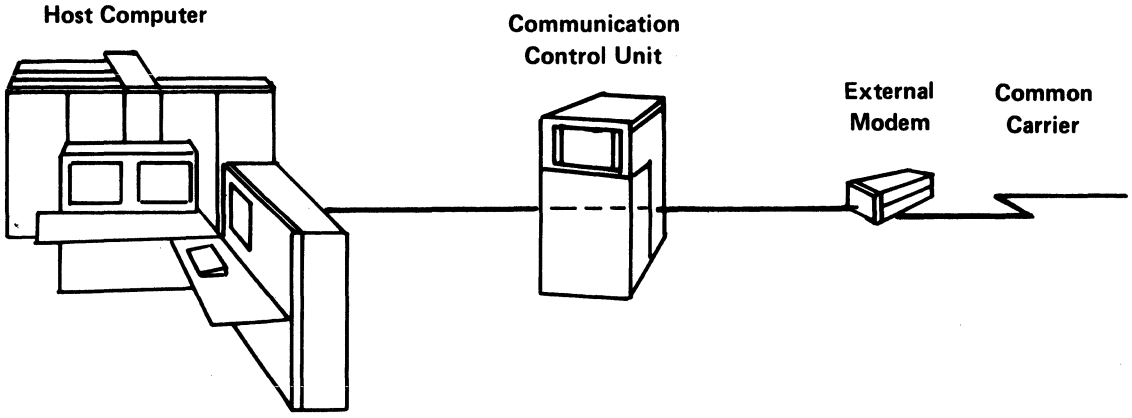
   - A1 Manual Answer Mode (CDT)
   - B4 Aural Monitoring Provided
   - C6 Rotary Dial (pulse operation).
     May not work on some "tone" only facilities.
   - D8 Voice Mode Indication
   - Fixed transmit level of -9db

   If the above options do not match customer requirements, the customer must provide his own phone. The phone must have a fixed transmit level of -9db, the D8 option and options A1 or A2, B3 or B4, and C5 or C6.

   - A2 Auto Answer Mode (CBS)
   - B3 Aural Monitoring Not Provided
   - C5 Touch Tone Dial

ROCF Host Site Configuration to Communicate with FC 9514

CDT-Type Protective Coupler	External Modem	Line Connection	Line Type
Not Required	Western Electric 202S or equivalent (See Note)	Common – Carrier Provided USOC as specified by external modem instructions	Switched Network Line for Data up to 1200 BPS



Note: The following Western Electric 202S Modem (or equivalent) strapping options are required:

* Local Copy Not Used
* Receive Data Squelch – 156 ms
* RS232C (Voltage) Interface
* Soft Carrier Turnoff – 24 ms
* Auto-Call Unit (ACU) Off
* Clear to Send (CTS) Delay – 180 ms
* Reverse Channel Not Used
* Auto-Answer Off (On for ROCF)
* Receive Data Clamp In
* Carrier under Control of RTS
* Business Machine Clocking
* Grounding – AA Connected to BB
* Speed Greater than 900 BPS
* Fast Carrier Detect (CD) Out – 23 ms

Appendix E. FCC Regulations Governing Integrated Protective Circuitry

(U.S.A. Only)

Devices for the IBM 4341/4381 Features 9512 and 9514 Integrated Protective Coupler are registered with the U.S. Federal Communications Commission (FCC).

In the U.S.A., the following statements about the operation and maintenance of these registered devices are required by the FCC and must be followed.

1. To ensure compliance with regulations about the repair of the registered device, field repair is limited to replacement of field-replaceable units only. No other field repair or adjustment to the registered device is permitted. A field repair can be legally performed only by authorized service personnel.
2. When a problem is determined to be in or caused by the protective coupler or special IBM exclusion key telephone, the coupler/telephone must be immediately disconnected from the public switched network.
3. Connecting this device to party lines or coin-operated telephones is prohibited.
4. Part 68 of FCC regulations states that, under certain circumstances, the telephone company may temporarily discontinue service and make changes in the facilities and services that may affect the operation of the user's equipment; however, the user shall be given adequate notice in writing to allow the user to maintain uninterrupted service.
5. The user is responsible to contact the telephone company before the device is initially connected to and/or permanently disconnected from the public switched network. The FCC registration number and ringer equivalence number (REN) (identified in Appendix D) must be provided to the telephone company.

Appendix F. Plugs and Receptacles

60-Hz Power Receptacles and Plugs			
Plug Type	A[4]	D[4]	E[4]
Plug [1, 2]	(R&S) 3720	(R&S) 3760	(R&S) 7328
Receptacle: R&S [2]	(R&S) 3743	(R&S) 3754	(R&S) 7324
Inline[6]	(R&S) 3913	(R&S) 3934	(R&S) 7428
Schematic: Face of Receptacle		[5]	[5]
Service Rating: Amperes Nominal Voltage	20 208/240	30 208/240	60 208/240
Phases	1	3	3
Wires[3]	3	4	4

Notes:

1. These plug types (or equivalent) are supplied with the machines. (Customer provides matching receptacles or inline connectors.)
2. R&S = Russell & Stoll.
3. Number of wires includes one insulated equipment grounding conductor, green or green and yellow.
4. Plug type is watertight.
5. The three-phase receptacle must be wired for correct phase rotation. From the face of the receptacle, the clockwise sequence from the grounding pin is Phase 1, Phase 2, and Phase 3.
6. When an R&S inline connector is used with flexible or watertight flexible metal conduit, an R&S FSA or JPA adapter is required.

Appendix G. Installation Planning Schedule and Checklist

This planning aid lists installation tasks and responsibilities in order of occurrence. If new site construction or major renovation is required, a considerably longer lead time and planning cycle will probably be required. Because data processing equipment requirements differ, use the following suggested schedule and list of tasks as a guide. It can be copied as required.

If any scheduled checkpoint is not met, **notify your IBM representative.**

Task, Consideration, and Time Frame	No Action Required	Scheduled Completion Date	Actual Completion Date
Eight Months before Delivery:			
1. Verify IBM equipment to be installed. (See "Scheduling the Installation" on page 1-1.)	------	------	------
2. Verify delivery and installation schedule for common carrier telecommunication equipment.	------	------	------
3. Determine prospective location. Prepare a list of components, storage cabinets, work tables, chairs, desks, and other furnishings to be used. In planning space requirements, have you considered:	------	------	------
a. Future expansions?	------	------	------
b. Floor loading?	------	------	------
c. Fire protection?	------	------	------
d. Safety of personnel and records?	------	------	------
e. Security?	------	------	------
f. Acoustics?	------	------	------
g. Vibration?	------	------	------
h. Potential for electromagnetic interference?	------	------	------
i. Possibility of atmospheric contamination?	------	------	------
j. Adequate access route for movement of equipment from receiving area to computer room (ramps, doors, corridors, elevators, etc.)?	------	------	------
k. Rigging required?	------	------	------
4. Make a scaled layout of the room and equipment. (See "Equipment Layout" on page 1-3.)	------	------	------
a. Service clearances and service access observed?	------	------	------
b. Operator convenience and storage of forms and other supplies considered?	------	------	------
c. Cable length limitations observed?	------	------	------
d. Place orders for any non-IBM supplied cables.	------	------	------
e. Channel priorities of devices considered? (IBM reviews this item with you at cable ordering time.)	------	------	------
f. Layout of units (including furniture, etc.) made by using scaled templates?	------	------	------
5. Determine floor loading (see "Floor Construction" on page 1-5).	------	------	------

Task, Consideration, and Time Frame	No Action Required	Scheduled Completion Date	Actual Completion Date
6. Use of raised floors (see "Raised Floor Recommendations" on page 1-6).	------	------	------
a. Adequate height for all equipment cables, plumbing, etc.?	------	------	------
b. Raised floor surfaces free of exposed metal?	------	------	------
c. Panel covering meets antistatic and resistance requirements?	------	------	------
d. Extra pedestals required?	------	------	------
e. Conductive path provided from metal raised floor (if used) to ground?	------	------	------
7. Determine if furniture antistatic characteristics meet resistance requirements. (See "Furniture" on page 1-7.)	------	------	------
8. Consider acoustic treatment of room. (See "Acoustic Treatment of Area" on page 1-7.)	------	------	------
9. Determine lighting requirements. (See "Lighting" on page 1-9.)	------	------	------
a. General lighting adequate?	------	------	------
b. Emergency lighting provided?	------	------	------
10. Determine air conditioning requirements. (See "Air Conditioning" on page 1-12.)	------	------	------
a. Size the air conditioning load by summing requirements for all heat loads (including personnel).	------	------	------
b. Present facilities adequate?	------	------	------
c. Humidity control required?	------	------	------
d. Temperature and humidity recording devices provided?	------	------	------
e. Air conditioning controlled by computer room power-off disconnect?	------	------	------
11. Determine power requirements. (See "Power Requirements" on page 1-16.)	------	------	------
a. Voltage limits meet IBM equipment specifications?	------	------	------
b. Total load computed by using power profile information provided by IBM?	------	------	------
c. Arrangements made for any additional services required?	------	------	------
d. Computer power panels connected to feeders that serve no other loads?	------	------	------
e. Computer power panels easily accessible, preferably in computer room?	------	------	------
f. Circuit breakers labeled to identify which branch circuits they control?	------	------	------
g. Computer power panel grounded to service entrance ground or suitable building ground?	------	------	------
h. Branch circuit grounding wire insulated?	------	------	------
i. Each branch circuit receptacle checked for proper phase rotation?	------	------	------

Task, Consideration, and Time Frame	No Action Required	Scheduled Completion Date	Actual Completion Date
j. Required room emergency power-off controls located at operator area as well as at main computer-room exit doors?	------	------	------
k. Room emergency power-off provided for any equipment located remote from the main computer room?	------	------	------
l. Lightning protection requirements considered?	------	------	------
m. General purpose convenience outlets installed?	------	------	------
n. Standby (backup) power system planned? Type?	------	------	------
12. If previous equipment must be retained and operated while new units are being installed:	------	------	------
a. Additional power required?	------	------	------
b. Temporary power circuits required?	------	------	------
c. Additional temporary air conditioning required?	------	------	------
d. Temporary layout planned for the transition period?	------	------	------
e. External cables available?	------	------	------
13. Determine safety requirements. (See "Safety and Fire Precautions" on page 1-21.)	------	------	------
a. Computer in a fire-resistant area or room?	------	------	------
b. Computer area isolated from hazardous processes and materials?	------	------	------
c. Fire protection equipment available?	------	------	------
d. Emergency plan for personnel and records evacuation established?	------	------	------
14. Is space planned for storage of data recording media within specifications? (See "Storage of Data Recording Media" on page 1-23.)	------	------	------
15. Verify all contractor and vendor related activity schedules to ensure that facilities are ready when equipment is delivered.	------	------	------
Six Months before Delivery:			
Verify the following schedule:			
1. Installation of power.	------	------	------
2. Installation of air conditioning.	------	------	------
3. Delivery of equipment.	------	------	------
4. Installation of equipment.	------	------	------

Task, Consideration, and Time Frame	No Action Required	Scheduled Completion Date	Actual Completion Date
Four Months before Delivery:			
1. Review the **Eight-Month** check list.	------	------	------
2. Review equipment to be installed and finalize layout plan.	------	------	------
3. Submit the layout plan to IBM so that IBM-supplied cables can be ordered.	------	------	------
4. Verify plans for installing cables through permanent walls or floors.	------	------	------
5. Confirm all contractor and vendor schedules to ensure that schedules are compatible with equipment delivery.	------	------	------
6. Confirm that all telephone or Postal Telephone and Telegraph (PTT) line installation schedules for Remote Support Facility and telecommunication equipment are compatible with equipment delivery schedules.	------	------	------
Two Weeks before Delivery:			
1. Review the **Four-Month** checklist.	------	------	------
2. Verify completion of all contractor and vendor activity.	------	------	------
3. IBM-supplied cables should arrive.	------	------	------
4. Accept delivery of IBM test equipment and furniture.	------	------	------
One Week before Delivery:			
1. Review the **Two-Week** checklist.	------	------	------
2. Air conditioning system operational?	------	------	------
3. Arrangements made for balancing air conditioning system to computer room load immediately after equipment installation?	------	------	------
4. Power facilities installed?	------	------	------
5. Branch circuits tested for proper phase rotation?	------	------	------
6. Physical facilities (plastering, painting, decorating, lighting, ramps, floors, etc.) completed?	------	------	------

Task, Consideration, and Time Frame	No Action Required	Scheduled Completion Date	Actual Completion Date
7. Communication facilities (voice and data lines, modems, couplers, etc.) installed and tested?	------	------	------
8. Remote Support Facility line and telephone handset installed and tested?	------	------	------
9. Cable holes cut in floor panels as shown on final layout?	------	------	------
10. Arrangements made for moving equipment from receiving area to final location?	------	------	------

Appendix H. Safety Information Translations

This appendix contains translations of safety-related information. Translations are shown according to their original English text location by sub-sections and chapters.

Plugs/Branch Circuits, Power Distribution System, Chapter 1

The following safety translations are shown for the CAUTION notice regarding plugs.

Attention!
Pour la sécurité des utilisateurs, dans les pays utilisant une prise de raccordement, cette prise doit être connectée à une prise d'alimentation correctement câblée et mise à la terre. Une prise d'alimentation mal installée ou un mauvais câblage de la prise de raccordement peuvent provoquer une mise sous tension dangereuse des parties métalliques accessibles de la machine et des boîtiers métalliques des deux prises.
Le client est responsable de l'installation de la prise d'alimentation et des éventuelles modifications effectuées sur le cordon d'alimentation. Il est recommandé de faire effectuer ces opérations par un électricien qualifié.

List of Abbreviations

A	ampere
ac	alternating current
A/cm	amperes per centimeter
ADU	automatic dialing unit
ambient	surrounding
ASHRAE	American Society of Heating, Refrigeration, and Air Conditioning Engineers
AT&T	American Telephone & Telegraph Co.
AWG	American wire gauge
blk mpxr	block multiplexer
BPI	bits per inch
BPS	bits per second
BSM	basic storage module
BTU	British thermal unit
°C	degrees Celsius
C	coupler
CA	communications adapter
CBS	automatic operation coupler
CCITT	Consultant Committee of International Telephone & Telegraph (WT)
CDT	manual operation coupler
CDU	coolant distribution unit
CE	customer engineer (service representative)
CER	customer engineering room
cfm	cubic feet per minute
ch-to-ch	channel-to-channel
chan	channel
cm	centimeter
cnsl	console
coax	coaxial
cond	conductor
conn	connector
cont	continuous
conv	converter
CPU	central processing unit (or processor)
CRT	cathode-ray tube
C-T-C	connector-to-connector
CTCA	Channel-to-Channel Adapter
ctrl	control
Cu	copper
CW	copperweld
DAA	data access arrangement
DASF	direct access storage facility
DAU	data adapter unit
dc	direct current
dist	distribution
dply	display
DRC	data recording control
DTE	data terminal equipment
E/ME/A	Europe/Middle East/Africa
EBCD	extended binary-coded decimal
EBCDIC	extended binary-coded decimal interchange code
EIA	Electronic Industry Association (or applicable local or national equivalent)
EPO	emergency power-off
ESD	electrostatic discharge
°F	degree Fahrenheit
F	front
FC	Feature Code
FCC	Federal Communications Commission
FE	field engineering
FLL	fixed loss loop
fr	frame
ft	feet
gpm	gallons per minute
H	height
hp	high pressure
HP	horsepower
Hz	hertz
ICA	integrated communications adapter
ID	identification
in	inch
I/O	input/output
IPCEA	International Power Cables Engineering Association
k	kilo- (1000)
K	1024 (2^{10})

kb	kilobyte
kbps	kilobytes per second
kg	kilogram
kg/m²	kilograms per square meter
kVA	kilovolt ampere
kW	kilowatt
kybd	keyboard
L	left
LA	line adapter
lb	pound
lux	lumens per square meter
M (or m)	meter
max	maximum
MCM	thousand circular mils
m³/min	cubic meters per minute
MES	miscellaneous equipment specification
mfg	manufacturing
MG	motor-generator
min	minimum, minute
mm	millimeter
MP	multiprocessing
mpxr	multiplexer
ms	millisecond
MSC	mass storage control
MSF	mass storage facility
MSS	mass storage system
MTU	magnetic tape unit
NCU	network call unit
NEC	National Electrical Code
NEMA	National Electrical Manufacturers' Association (or applicable local or national equivalent)
NFPA	National Fire Protection Association (or applicable local or national equivalent)
No	number
nom	nominal
NTT	Nippon Telephone and Telegraph
OCP	operator control panel
OD	outside diameter
OEM	original equipment manufacturer
P&S	Pass & Seymour
PCDU	power and coolant distribution unit
PCI	power control interface
PD	protection device
PDU	power distribution unit
pF	picofarad
pH	hydrogen-ion concentration
ppm	parts per million
proc	processing
psi	pounds per square inch
psig	pounds per square inch gauge
PTT	Postal Telephone and Telegraph
PVC	polyvinyl chloride
pwr	power
R	rear
R & S	Russell & Stoll
rdr	reader
REN	ringer equivalency number
rel	relative
rfi	radio-frequency interference
RPQ	request for price quotation
Rt	right
S	side
SDA	synchronous data adapter
sec	second
seq	sequential
SF	special feature; sales feature
SP	support processor
slr	selector
stg	storage
T	top
TNL	Technical Newsletter
UK	United Kingdom
UL	Underwriters Laboratory
U.S.A.	United States of America
USOC	Universal Service Order Code
V	volt
VFL	variable field length
W	watt
WE	Western Electric
WT	IBM World Trade

Glossary

bus. One or more conductors used for transmitting signals or power.

modem. Modulator/demodulator (a device that modulates) and demodulates signals transmitted over communication facilities).

oersted. Centimeter-gram-second electromagnetic unit of magnetizing force (A/cm 1.256 oersteds).

service clearance. Minimum space required to allow working room for the operator and the service representative.

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